THURSDAY, FEBRUARY 3, 1876

THE UNIVERSITY OF LONDON AND SCHOOL EXAMINATIONS

EXAMINATIONS, like fire and many other useful things within their proper limits, are good servants, but very tyrannous masters. It is excellent that knowledge should be tested; that men—and shall we say women—shall be found out for their souls' good if they innocently deceive themselves as to their acquirements, for the sake of the community if they assume knowledge they really do not possess. Unfortunately, what was once a means bids fair to become an end; and it is quite certain that a great deal of knowledge is acquired nowadays which finds its only use within the walls of the examination room. It is perhaps a law of human nature that those who have bitterly endured the harrow—not to suggest metaphorically another implement—are ever afterwards eager that all mankind should endure the same process with no feature of its asperity mitigated. In the Report of the Sub-committee of the Annual Committee of the Convocation of the University of London on the Examination and Inspection of Schools, this feeling makes itself curiously apparent:—

"The Universities of Oxford and Cambridge having for many years held local examinations, and having recently initiated a joint scheme, in accordance with which they have examined a progressively increasing number of schools, your Sub-committee fear, that unless this University is prepared to undertake a share in this great work, many schools, which have hitherto acted as feeders to this University, will grow into organic relation with the older Universities, and that, consequently, *the number of candidates for the London examinations will sensibly decrease.*"

The two ancient Universities having, it will be seen, started a system which has affected, most beneficially, the middle-class education of the country, and this system having worked successfully for many years, are now practically extending it to the higher grade schools. The Annual Committee have not a word to say as to the efficiency of the work, although, as we have frequently said in these columns, much is to be objected as to the position given to science in it. It might, then, be conceived, that there was no need for the modern University to do more than to wish the older ones God-speed. But no; there is no salvation in Oxford and little in Cambridge, and that students should from their youth upwards lean to these *almæ matres* and turn away from the *sicca nutrix* of the metropolis—the examining board with all its sternest features unmitigated by the prestige of a professoriate, or the ameliorations of a traditional culture—was a thing not to be endured. The University must be at least true to its principles. When on the eve of the elections of the present Parliament, people were dimly suspecting the beginning of the end of the Liberal administration, Mr. Lowe, addressing his constituents in Convocation, devoted all his powers to the task of portraying the terrible things that must happen if the Conservatives ever came to power. He passed lightly over the disappearance of a surplus—that was too normal a phenomenon with Tories. But he touched a chord on which he knew the response would not be doubtful, when he hinted that possibly the Conservatives might tamper with the principle of competitive examinations; with almost painful earnestness he pleaded hard for mercy as regards that cherished institution. He knew his audience well, and felt that they at least would never neglect the sacred charge, or forget that the true destiny of the human animal, from its youth upwards, is the examination room

It will perhaps be thought that in this matter we have spoken with undue irony, even it may be thought with undue levity. But is it easy to speak with reasonable seriousness of an attitude like that which the Annual Committee has adopted? Surely if the school-examinations were ill-conducted by Oxford and Cambridge the nation would owe the University of London a debt of gratitude if it undertook in good faith to do them better. But there is no evidence that they are ill-done; indeed, there has not been sufficient time to express any comprehensive opinion about them. A good deal is no doubt to be said as to the inadequate place which science holds in these examinations. But for the present the more dignified course for the University of London to adopt—and one which its actual rulers, the Senate, will, it is to be hoped, take into consideration—is to defer any action in this matter till the Oxford and Cambridge system has at least been tried. It is not by entangling schoolboys in its meshes, but by the high standing which is maintained for its superior degrees, that the prestige of Burlington Gardens will be sustained; and in the interests of learning, rather than of examinations, it is to be hoped that grounds of action so cynical will not be again put forward.

GUTHRIE'S "MAGNETISM AND ELECTRICITY"

Magnetism and Electricity. By F. Guthrie, Professor of Physics at the Royal School of Mines. (London and Glasgow: W. Collins, Sons, and Co., 1876.)

DR. GUTHRIE has evidently devoted considerable time and care to the preparation of this text-book. It has undoubtedly a freshness and originality of treatment which, though apt to shock electricians in parts, yet places this treatise in striking contrast to some science class-books of mushroom growth, that bear the mark of scissors and paste on every page. In such books the text too often seems written to illustrate the threadbare woodcuts; here, however, the illustrations are original, and usefully aid the author's meaning. It is true in some cases the cuts are rough and poorly engraved, *e.g.* Figs. 90, 105, 107, 112, 123, 183, and 274, and it is to be regretted that, in the case of instruments at any rate, the illustrations are not drawn to scale but often greatly out of proportion, the reason for which, the author states, is better to show principles; but this hardly applies to apparatus which the student or instrument maker may have to construct from the figures. We like, however, the quaintness seen in many of the terms employed; such as the use of "tandem" to describe cells grouped in simple circuit by "joining the family of zincs to the family of carbons" (p. 183), and the term "abreast," employed to indicate the compound circuit; a source of voltaic electricity is called an "electrogen," and the transport of the products of electrolysis is termed "migration

of the ions," &c. Some of the illustrative analogies given by the author are also very happy, as, for example, the ease with which the molecular transfer is effected in electrolysis is compared to the ease with which a chain hanging over a pulley is moved: "When the two sides are equal each link on one side may be conceived as keeping in equilibrium the opposite link on the other side. A slight force pulling one side down will bring each link opposite to a different one" (p. 137). Incidentally, one or two of the new things strike us as open to question: for instance, the habitual use of the word isolate instead of insulate; the former has a French aspect, and certainly is less familiar to English readers than the latter term. Again,

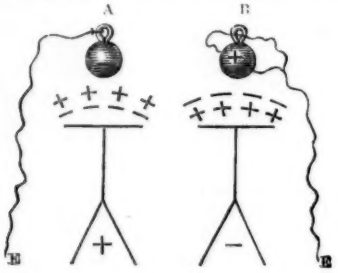

FIG. 1.

the omission of all names of discoverers, because, the author states in the preface, "the book is not a history of discovery;" nevertheless, is it not well that students should be able to associate with Faraday's name, for instance, the famous discoveries he gave to the world? and with all the author's care one or two less important names have crept in, that thus have an undue prominence given to them. On the other hand the unostentatious tone of the book and the entire omission of any reference to the writer, even in the description of the instruments he has devised or the facts he has discovered, are excellent traits, and quite characteristic of the author.

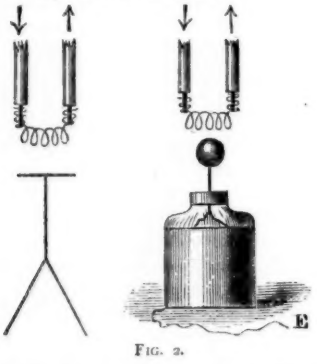

FIG. 2.

The following extracts will illustrate the remarks we have made, and afford our readers an idea of the experimental portion of this treatise. Here is an experiment of the author's which is of considerable interest, whatever explanation may be accepted:—

"When at a bright white heat, an iron ball refuses to receive, or at least to retain, even for a moment, a charge of either + or − electricity. On cooling down, but while still of a red heat, it acquires the power of receiving a − but not a + charge; and this distinction is maintained through a considerable range of temperature. At a lower temperature yet, but still at a dull red heat, the ball begins to be able to receive + electricity, and shortly after, as it cools, it accepts both kinds with nearly equal readiness. . . . Again, if we take two equally-charged gold-leaf electroscopes (Fig. 1), one charged with + and the other with − electricity, and if we bring earth-connected white-hot iron balls a few inches above the caps of each, they will be discharged with nearly the same facility. On repeating the experiment continually, as the balls cool, it is found that A, or the +ly charged electroscope, ceases to be discharged, though the ball is of a red heat, while B, or the − electroscope, continues to be immediately discharged, although the ball has lost all incandescence."

The explanation of this phenomenon Dr. Guthrie takes to be as follows:—"If we conceive the air-bathed and electrically air-straining masses of iron, A and B, to be respectively +ly and −ly electrified, and then to be gradually heated, the air which we have already partly seen to have a greater attachment to + than to − electricity will, supposing the attachment between the metal and both kinds to be equally diminished, succeed first, in the molecular turmoil at the heated surface, in carrying away the +" (p. 81). Hence the apparently opposite effect seen in Fig. 1 is due to the inductive action of the charged electroscope upon the earth-connected ball over-head, so that the ball in A is negatively electrified and retains its charge, whereas in B the ball becomes positively electrified and dissipates its charge as fast as it is renewed, and hence in this case the electroscope is discharged as if by a point. The same power of discharge can be shown by replacing a hot ball with a platinum wire made white hot by a current. Fig. 2 shows an electroscope and a Leyden jar being discharged in this manner.

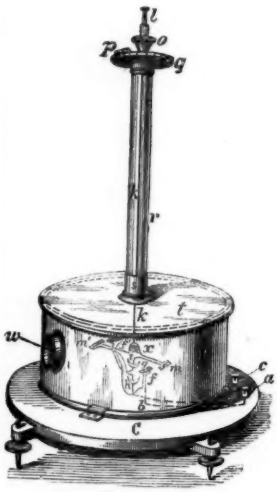

FIG. 3.

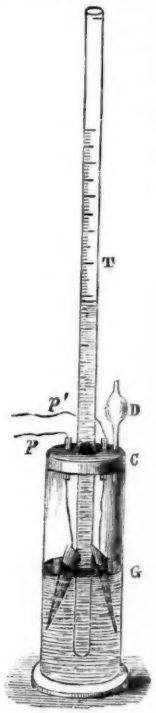

FIG. 4.

Fig. 3 shows an ingenious torsion galvanometer, devised, we believe, by the author, and which is stated to be free from many sources of error.

An ingenious contrivance, due to the author, is shown in Fig. 4. This is a so-called voltastat, an arrangement whereby the current interposes "by its own greater or less action a greater or less resistance in its own circuit," and thus the voltastat or automatic rheostat behaves like the governor of a steam-engine. There are of course several obvious disadvantages in the use of such an instrument, but we cannot recall any other continuous self-acting "voltastat." Helmholtz, in order to keep the disc of his siren rotating at a constant rate, employed an electro-magnetic arrangement with attached governor, but here the current was interrupted when it exceeded a certain strength.

In the electro-chemical portion of this treatise students will find much information concerning the reactions within various forms of batteries and in the electrolysis of salts, and some interesting facts on electric osmose. The explanation Dr. Guthrie gives of the prevention of "local action" by amalgamation of the zinc is new to us. The chief cause of local action—which the author describes as "a coasting trade"—is attributed to difference of hardness rather than metallic impurities on the surface of the zinc; mercury, it is asserted, removes this inequality of hardness due to irregular cooling, "for as the mercury penetrates, the mass softens and molecular strains are relieved, and uniformity results" (p. 141).

And here we would note one or two minor experimental statements in the book which we think it would be an advantage to modify, as readers might unintentionally be misled. In speaking of the electrolysis of water the author states that in the first portions of the gas collected the hydrogen is less than its theoretical proportion. "This is due to the 'occlusion' of hydrogen by platinum under these circumstances. The hydrogen is absorbed by the platinum. Very soon, however, the metal becomes saturated, and the exact combining ratio is observed" (p. 157). This effect, we imagine, must very promptly be masked by a contrary action—to which Dr. Guthrie does not allude—for, except under special circumstances, the amount of *oxygen* is perceptibly deficient in electrolysis, and, as is well known, is due to the formation of ozone. And is not the following electro-chemical statement also open to comment?—"Hydrogen, when freshly liberated, has, as is well known, an exceedingly powerful reducing action. Use is made of this circumstance to protect the copper sheathing of ships, ... the evolution of hydrogen on the copper surface deoxidises any oxidised portion" (p. 128). A student might from this be led to infer that the electro-negative metal in a cell would not be protected unless hydrogen were evolved on its surface. Again, in describing the evolution of electricity by an ordinary electric machine, it is merely stated that "the + electricity enters the prime conductor, and − leaves it; the prime conductor thus becomes +" (p. 52). A reference to the inductive action exerted on the prime conductor, the high tension at the points, and therefrom the discharge of the induced opposite electricity on to the machine, seems needed here.

We must now devote a few words to one feature wherein the present text-book differs from most of the ordinary manuals on electricity. Dr. Guthrie has sought to give the reader some acquaintance with terms and methods of measurement which in general are better understood by the practical electrician than the science teacher. Whilst every such effort cannot fail to be more or less useful, the present is, we regret to notice, open to criticism in several directions. But as we have neither the space nor the inclination to notice all the points we have marked, one illustration will suffice. On pp. 225 and 226 we have the unit of resistance set forth as follows: "Taking 1 second as unit of time, 1 metre as unit of length,* and 1 gramme as unit of weight, an 'absolute' unit of resistance is obtained by employing the above equations [viz., Q (or current strength) $= \frac{f d^2}{l m}$ and W (or current work) $= Q^2 r t$], and this multiplied by one hundred million is the Ohm or B.A. unit." Here, irrespective of other considerations, there is the fundamental error of using the term *weight* instead of *mass*, and moreover, the student must fail to grasp the idea that electric resistance can be expressed as a velocity, and has nothing to do with either weight or mass. There is no hint of these considerations in the manual before us; the electrostatic system of units is not even referred to, nor is the student made aware of the precise nature of the units described.

This text-book is open to criticism also in some other portions which deal with more familiar questions. Notably, take for example a proof connected with Ohm's law, given on p. 185; or the paragraphs on linear resistance, § 243—247, which certainly will bewilder the reader unnecessarily, when a more general result can be deduced more easily and obviously in as many lines as pages are here devoted to the subject. Nor is it necessary for the particular proof, even if it were true, that the potential at the zinc end of the battery is = 0, as stated on p. 221.

In § 257, referring to the effect of heat on the resistance of liquid conductors, the fact is lost sight of that mercury (quoted as militating against a theory that is given) is not an electrolyte, and so has nothing in common with the generality of liquid conductors. On p. 224 the author shows how the diameter of fine wires may be deduced from their length and weight, and then adds: "The relative diameter of two wires can be deduced from their weights, lengths, and *resistances*;" here weight, no doubt, was meant to be omitted. There is also an earlier paragraph needing great amendment, viz. § 214, where electrical resistance is compared with the resistance experienced by water in flowing through pipes; but as any analogy there might be is destroyed by the definition adopted of water-resistance, it is, we think, a mistake to have introduced the elaborate and withal erroneous comparison that is given. And surely two woodcuts of the same tube on p. 179 were hardly necessary, as if turning the tube one way or the other could make any difference in the reasoning. In fact, the evident care everywhere taken by the author to make his meaning clear, has perhaps led him occasionally to the opposite extreme of unnecessarily laboured explanations, so that some really

* After the strong reasons which exist in favour of the C.G.S. system of units, it is to be hoped that the centimetre will become more generally used as the unit of length.

simple matters become invested with an air of great difficulty. Thus, to take one other example, we should have thought it needless to devote so much space to the difference between a right and left-handed spiral, as is given on p. 242, *et seq.*

There are also several clerical errors and misprints throughout the book, which we regret we have not space to point out, as they ought to be corrected in a new edition; some of the woodcuts, moreover, need alteration.

In conclusion, we must remark that, although a careful perusal of this work has led us to notice several things which ought to have been different, yet we are not insensible to the good features of this unpretending text-book, and we hope, therefore, that Dr. Guthrie will have a speedy opportunity of removing the blemishes which seriously mar the usefulness of his book. In the strictures we have ventured to offer we trust nothing offensive to the author has appeared, for whom we entertain, and are glad to be able to express, our sincere respect.

TWO AMATEUR EXPLORERS

"*The Great Divide.*" Travels in the Upper Yellowstone in the Summer of 1874. By the Earl of Dunraven. With Illustrations by V. W. Bromley. (London: Chatto and Windus, 1876.)

Yachting in the Arctic Seas; or, Notes of Five Voyages of Sport and Discovery in the neighbourhood of Spitzbergen and Novaya Zemlya. By James Lamont, F.G.S., F.R.G.S. Edited and Illustrated by W. Livesay, M.D. (Same publishers.)

THE number of works of travel published within the last few months is probably unprecedented. Scarcely a week has passed during that time in which we have not had occasion to notice one or more in these columns. One noteworthy feature about these narratives of travel is that few of them are by what may be called professional explorers, men who have led expeditions into unknown or little known lands and seas for the sole purpose of extending our knowledge of them. They are mostly written by men who, solely from a love of adventure and sport, have left all the comforts and luxuries which wealth and a high social position can bring to undergo many of the hardships and privations which fall to the lot of those who have adopted discovery as their work in life. No doubt improvements in modes of travel, and especially in steam navigation, have something to do with this, as has also the tedium which occasionally comes upon every intelligent man who has to plod the weary round of the duties, and especially the pleasures, of civilised life. But, as we said last week, we are inclined to attribute this growing love of travel, of amateur exploration, in some degree to the general advance of intelligence urging those who can afford it to gratify their craving for knowledge by stronger stimulants than can be obtained from books. Possibly also some may think this growing love of travel in wild regions, mingled as it often is with intense delight in dangerous sport, is to some extent a breaking out of remote ancestral habit, of a habit which still clings to us from a time when our ancestors, like existing savages, were explorers and hunters of the wildest animals for dear life—a habit which only requires a favourable opportunity to be re-developed, though with a different aim. Whatever may be the causes, there can be no doubt about the fact of the rapidly-growing love of adventure and discovery, involving dangers and hardships of a very real kind. No better examples could be found than those of the authors of the two works before us.

The scene of the Earl of Dunraven's wanderings is in and around that wonderful and interesting region of North America, on the borders of Montana and Wyoming, known as the Yellowstone Park, which the U.S. Government have had the wisdom to set aside as a "gigantic pleasuring ground." Anyone looking at a good map of the United States will perceive the appropriateness of the term "The Great Divide" as applied to the mountainous region in the neighbourhood of the Upper Yellowstone. It is indeed the geographical centre of North America; here the principal rivers of the United States take their rise and flow in all directions—north, south, east, and west. We have already (vol. vi., pp. 397, 437) given considerable details and several illustrations of this remarkable region of gigantic geysers, and boiling mud and sulphur springs, and not much has since been done to add to our knowledge of it. The Earl of Dunraven, during the few weeks he spent in the district with a few boon companions, made a pretty careful examination of some of the most remarkable phenomena, and the record of this, supplemented by copious extracts from the accounts of the U.S. exploring expeditions, will give the general reader a very fair idea of the characteristics of this strange region. The Earl reached the Upper Yellowstone region by travelling northwards from Corinne on the Great Salt Lake; and both on his journey northwards, during his hunting of the mountain-sheep or bighorn (*Caprovis Canadensis*), the wapiti, and other wild animals, and his exploration of the geyser and boiling spring region, he and his party occasionally endured considerable hardship, which, however, they all seemed thoroughly to enjoy as an essential part of the programme of the expedition. Considerable details are given as to the character and condition of the various tribes of Indians to be met with in the neighbourhood of the region traversed, and the Earl has much to say on the Indian question. We do not think, however, that our ignorance of the Indian, his habits and traditions, is so great as the Earl would make out to be the case. There really exists a vast amount of information concerning the aborigines of North America at least, and Mr. Bancroft is doing good service in collecting into one magnificent work all that is known of the natives of the Pacific States. Still there can be no doubt that the American Indians are rapidly dying out, and in the interests of science it would be well to use all diligence in supplementing the doubtless by no means complete information we at present possess. As to civilisation and conversion, the Earl of Dunraven has as bad an opinion of the Indian as Mr. Monteiro and Capt. Burton have of the nature of an African.

On the whole we may say that the Earl of Dunraven's work is a jolly rollicking narrative of adventure and sport, mixed up with a great deal of useful information concerning one of the most interesting regions in the American continent. The illustrations are interesting, and some of them help out considerably the descriptions in the text,

A good map of the territories around the Yellowstone region, and a large scale-map of the Upper and Lower Geyser Basins, enable the reader to follow the author in his wanderings and descriptions.

From a scientific point of view Mr. Lamont's book is more valuable than the one we have been speaking about. So long ago as 1858-59, Mr. Lamont made voyages, mainly for sport, to the Spitzbergen Arctic region; and in 1869-70-71 he made other three voyages. In the volume before us he has brought together some of the most valuable results of his observations during these voyages, and while devoting considerable space to his sporting adventures with the walrus, the seal, and the bear, he gives much information of scientific value. His sporting skill stood him in good stead, as from his large takes of walruses, seals, and bears, not to mention reindeer and smaller game, he must have been, in 1869 at least, considerably recouped for the expenses of his voyage.

Mr. Lamont, very naturally judging from his own success, is inclined to place more value on private Arctic enterprises than on elaborately equipped Government exploring expeditions. He refers to the expedition in the *Polaris*, commanded by a civilian, and which got further north than any ship had previously done. But we think that any one who reads the narrative of that unfortunate expedition unprejudicedly, must conclude that had the expedition been under strict naval discipline it would have reached a point still further north, would have accomplished more in the way of scientific observation than it did, and would not have ended with the disaster that befell it. The last Payer-Weyprecht expedition, though not a Government one, was practically under naval discipline, and the English Government expeditions referred to by Mr. Lamont, did not fail in their endeavours to push northwards because they were such. But Mr. Lamont speaks as if the main object of Arctic exploration were to get as far north as possible, whereas, in the eyes of scientific men, this is a point of minor importance; and they maintain rightly, we think, and their opinion is supported by past experience, that no Arctic expedition can be adequately equipped to collect all the scientific data which can be so abundantly obtained in these regions, unless it be sent out by Government and be conducted with all the method and strictness which naval discipline alone can enforce. Private enterprises like those of Mr. Lamont and the whale fishers, can do much to add to our knowledge of the Arctic regions, but if we had had to depend entirely on such means, what would have been the amount and value of our knowledge at the present day?

Mr. Lamont gives a minute description of the construction of his admirably built steam yacht the *Diana*, which came unscathed through many dangers. In 1869 he sailed as far as the Kara Straits, which he did not enter. Next year, however, he passed through Pet or Jugor Straits, and penetrated a short distance into the Kara Sea, coming out by the Kara Straits. He sailed up the west side of Novaya Zemlya as far as Admiralty Peninsula, and after several trials succeeded in passing through the Matoschkin Schar. He landed on several points of the island, and gives some valuable notes on the fauna and flora which he observed. In 1869 he sailed along the edge of the ice-pack a little north of the 75th degree of latitude, to Spitzbergen, the coasts and gulfs and islands of which in his various voyages he has examined with great minuteness, and contributes several notes on the physical geography and natural history, which will be found of value as supplementary to those of other observers. Regular temperature soundings were taken and the surface-temperature observed, the condition and movements of the ice noted, especially in the Kara Sea, as well as any evidences of currents; and Mr. Lamont's observations on these points, and especially on the movements of the ice in the Kara Sea, we would recommend to the notice of all interested in Arctic physics and Arctic geography. Mr. Lamont has a right to be considered an experienced Arctic observer, and his opinions should be received with respect. Years ago he conjectured that land should be found to the north between Spitzbergen and Novaya Zemlya; the Payer-Weyprecht Expedition has confirmed this conjecture. He tried hard to get at least a sight of Wiche's Land, but failed, though the Norwegian captains succeeded in reaching it in 1872; for there is no doubt that Petermann's King Karl Land is that discovered by Edge 250 years ago. Mr. Lamont thinks it possible that it may be connected with the recently-discovered Franz Josef Land.

Mr. Lamont records not only his own observations, but being well up in the literature of the exploration of the region he visited, gives many valuable notes of the work done by previous explorers, as well as by some who have been there since his last voyage. We would recommend to naturalists his observations on the differences between the reindeer of Spitzbergen and that of Novaya Zemlya; the former he thinks identical with the wild and tame deer of Norway and Lapland, whereas the Novaya Zemlya type appears to him more allied to the reindeer of the American Continent. His theory as to the migration of the Spitzbergen type is very remarkable.

There are many illustrations throughout the work, some of them not well drawn, but all of them helping the reader to realise what is to be seen in the regions to which they refer. Various maps and outlines of coasts add to the value of the work, which we assure our readers they will find full of entertainment and information.

OUR BOOK SHELF

Die Neuere Schöpfungsgeschichte nach dem gegenwärtigen Stande der Naturwissenschaften. By Arnold Dodel, Privat-docent at Zürich. (Leipzig: Brockhaus, 1875.)

ANOTHER work on Evolution, equalling the "Origin of Species" in size. The author of these twelve lectures has carefully studied every important work on the subject, and endeavours to give a plain and intelligible account of Evolution in relation to the whole field of biology. The style of the work is vigorous and combative, and considerable success in exposition is attained. But many definite conclusions are announced where the most far-seeing evolutionists would only put forward tentative hypotheses. We think it will be far more advantageous for German or other students who have any real knowledge of biology to study for themselves Mr. Darwin's works than to take a less efficient, though an honest and accomplished guide in Dr. Dodel. The book is well illustrated with engravings of interesting structures in plants and animals bearing on Evolution; it also contains a

number of hypothetical scenes illustrating the fauna and flora of the past, as well as several phylogenetic trees.

Le Valhalla des Sciences Pures et Appliquées, galerie commémorative et succursale du conservatoire des Arts et Métiers de Paris, a créer dans le Palais Neuf de Mansart, au Château de Blois. Par le C^te^. Léopold Hugo. (Paris, 1875.)

THE four names of Watt, Fulton, Stephenson, and Denis Papin, inscribed on the roof of the railway station at Blois, suggest a train of thought to the author in connection with the triumphs of steam and its applications. Having previously described the Château de Blois, the writer puts forward a proposal (sometimes he calls it a dream) to turn the now abandoned château into a noble valhalla of science. A principal feature is a statue of Papin (born at Blois about 1650); there should be also statues of other scientific writers of all time and climes, appropriate inscriptions, portraits on the walls, and representations of interesting scenes in the history of science, chambers for the exhibition of models and instruments, a scientific library, and other matte s. So his dream is to make this a Versailles of science. A classification of the sciences and a plan close this part of the pamphlet. We do not, however, concern ourselves here with this proposal or dream or whatnot, but pass on to a brief glance at the three appendices. The first is "Definition de la double-tendance Philosophique de la Science." Noting the objects the "immortal" Bacon had in view in his New Atlantis, he applies himself to the consideration of what is the classification that we can make of the sciences, and combats Auguste Comte's arrangement according to the increasing complexity which appears inherent in them. In our author's eyes all sciences have the same complex character (caractère de complication) either virtually or actually. Comte begins with mathematics, Hugo exalts them to a high place: "L'intérêt philosophique des sciences mathématiques est de marcher à la rencontre des sciences naturelles. Il n'y a rien là qui ressemble à une subordination des certaines sciences." The second is "Examen géométrique sommaire des orbites planétaires (ovhélites)." The writer remarks that recent discoveries in Astronomy have pointed to a new movement of the solar system in space, hence the orbit or trajectory of our planets is not a plane curve. This orbit is a helicoidal curve with an elliptical or oval projection. Hence ov-hél-ite. In the geometrical description of such a curve we must indicate whether the trace is *dextrorsum* or *sinistrorsum*. The ovhélites of the planets and of the earth are geometrically traced *sinistrorsum*. In this paper, which was originally communicated to the Mathematical Society of Paris, the author states the theorem "Les ovhélites planétaires sont tracées sur les cylindres à section droite elliptique (sauf perturbation) ou du moins ovalaire. Une des lignes focales des susdites ovhélites est commune; cette ligne est la trajectoire solaire." The third appendix is "Base scientifique de la numération décimale." We will again let the Count speak for himself, "Je propose aujourd'hui d'utiliser une des plus anciennes et des plus curieuses théories de la géométrie, restée jusqu'à ce jour sans emploi, pour établir un lien entre la géométrie et l'arithmétique, en donnant comme base à cette dernière science un *nombre absolu et éternel*." The five regular solids were treated of by Pythagoras. Cauchy and Poinsot have added to these four stellated polyhedra. "En y joignant à mon tour la sphère (qui est le régulier infinioïdique) j'arrive à constituer géométriquement le nombre infranchissable de DIX." Thus we see there is a resemblance between the nine digits and zero on the one hand and the nine regular polyhedra and the sphere on the other. Further, there is a curious feature, there are five primes among these, and there are five regular convex solids. Such then is "la conception philosophique et vraiment scientifique du nombre fondamental DIX." After two thousand years we have arrived at an application of the theory of the regular figures, there is hope also of establishing a rival to Euclid. A commission was appointed in March of last year to pronounce upon the Hugodecimal theory. "De la propriété régulière essentielle de l'espace, de l'absolu régulier, avoir fait jaillir le nombre DIX!" These are the principal points of interest in the pamphlet.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

The Article "Birds" in "Encyclopædia Britannica"

IN reply to Prof. Huxley's letter of last week with reference to my review of the article "Birds" in the "Encyclopædia Britannica," I may mention that it is to the illustrious Nitzsch, as far as I am aware, that we owe the combination of the Swifts and the Humming Birds into a single family. Burmeister's edition of Nitzsch's "Pterylography" was published in 1840, and in Mr. Sclater's translation of that invaluable work (p. 86) we read, under the heading MACROCHIRES, "In this family I place the two genera, *Cypselus* and *Trochilus*, which indeed present but little external similarity, but are very nearly allied in the structure of their wings."

In 1867, the year in which Prof. Huxley promulgated his Classification of Birds, the palatal structure of the Humming Birds was imperfectly known, as may be gathered from the following passage in his memoir* with reference to the Cypselomorphæ:—"The vomer is truncated at the anterior end, and the maxillo-palatines are slender and disposed nearly as in the typical Coracomorphæ (*? Trochilus*)." I believe that, at that time, no accurate account of it had been given by anyone.

When, in 1873, after I thought that I had fairly mastered Prof. Huxley's classification, Mr. Parker kindly informed me verbally that from his investigations on the subject he had discovered that the vomer of the Trochilidæ is sharp-pointed instead of being truncated. Upon re-reading Prof. Huxley's data for his division of Carinate birds in the Schizognathæ and the Desmognathæ, in both which groups the vomer is *pointed* (or not ossified), and the Aegithognathæ, in which the vomer is *truncated*, I naturally was led to see, as Mr. Parker has since stated in print,† that the Trochilidæ are not Aegithognathous, but Schizognathous; and I further inferred, justly I believe, that if Prof. Huxley had, in 1867, known that the vomer of the Humming Birds is sharp-pointed instead of being truncated, he would never have placed the Trochilidæ among the Aegithognathæ, for in so doing he would have been compelled to have given up the only common character of any importance which links together that group. When, therefore, I say in my review that "Professors Huxley and Parker place them [the Swifts and the Humming Birds] in quite different divisions," there can be no objection to my including Prof. Huxley's name with that of Mr. Parker in a *general* remark which is so fully borne out by the spirit of the classification introduced by the first and adopted by the second of these illustrious biologists.

That Prof. Huxley did, in 1867, adopt Nitzsch's combination of the Swifts with the Humming Birds, I would not attempt to deny, but *then* the palatal structure of the latter sub-family was not correctly known.

10, Harley Street A. H. GARROD

The Difficulties of the Public Analysts

HAVING for some time past watched with painful interest the prosecutions under the new Adulteration Act, and seeing very clearly that whatever may be its success or failure in reference to its intended object, this Act of Parliament is becoming eminently successful in bringing chemical science into contempt, I am glad to see that you have taken up the subject in the columns of NATURE. I hope that it will be freely discussed. It may be safely affirmed that in the majority of cases where the vendor has made an effort to defend himself he has been able to flatly and positively contradict the certificate of the public analyst by counter-certificates of other analysts of equal or superior eminence. The butter case you have quoted is no exception, but may be taken as about a typical or average sample of such prosecutions. If this deplorable state of things is to continue,

* Proc. Zoolog. Soc. 1867, p. 468.
† Trans. Zoolog. Soc. vol. ix. p. 292.

the general public will be perfectly logical in concluding that either the public analysts are generally incompetent, or that chemical analysis is self-contradictory, and therefore worthless. The subject is one that seriously affects the dignity and general interests of science.

Much of the blundering that has unquestionably occurred is doubtless due to the peculiar position of public analysts and the impossibilities they are called upon to perform. The political economist tells us that "demand for commodities induces a corresponding supply," and the Adulteration Act was evidently framed upon the assumption that analytical skill is a "commodity" subject to this law, as it demanded the immediate creation of a whole army of chemists endowed with a peculiar kind of knowledge and skill, which was not to be acquired in any college, school, university, or other educational institution, public or private, in Great Britain. Laboratories existed wherein the analyses of acids, bases, and salts, organic and inorganic, were carefully taught, and others where special attention was devoted to pharmaceutical preparations; but where (before the passing of this Act) could a student find a laboratory in which he might learn how to analyse the multitude of articles that pass over a grocer's counter, and acquire the *commercial* knowledge which is as necessary to the public analyst as analytical skill? I use the past tense here, knowing that since the passing of the Act many public analysts have industriously and meritoriously availed themselves of the opportunities afforded at one laboratory that has been specially devoted to the useful purpose of affording them the special analytical skill they should have possessed before obtaining their appointments. There do not, however, appear to be any sufficient means provided for the commercial and technological education of public analysts.

As an example of the necessity of commercial or technical knowledge, I need only refer to the discoveries of "iron filings" in tea which were so common until lately, the absurdity of which I have already demonstrated by simply calculating the number of tons of iron filings that would be annually required for the alleged adulteration, and showing the practical impossibility of obtaining such a supply, either here or in China. Iron was found in the tea unquestionably,—the chemistry was not at fault,—but the theory which confounded accidental impurity with wilful adulteration arose from lack of technical knowledge, the possession of which would have shown that leaves carelessly gathered and thrown upon the dusty ground of a highly ferruginous soil, and then roasted, must of necessity be mingled with more or less of magnetic oxide of iron, besides the iron naturally contained in the ashes of this particular plant.

The series of butter cases, of which the one you quote is only a recent and ordinary example, illustrate the same want of trade knowledge on the part of nearly all concerned. I have been surprised at the repeated and uncontradicted assumption that butter must be adulterated because it is cheap, which has run through all these cases. We all know that good butter at this season is not obtainable at less than 1*s.* 8*d.* per lb., and much is sold at 2*s.*, and therefore it is inferred that if butter is offered for sale at 10*d.* or 1*s.* it must be adulterated. This is a very plausible inference, but nevertheless a great mistake, which public analysts and sitting magistrates have evidently shared with the general public. But for irritating old sores, I might quote from early prosecutions, and show how an inspector and public analyst have evidently been so biassed and deceived by the simple fact that butter was offered for sale at 8*d.* per lb., and that the analyst interpreted equivocal analytical results according to such preconceptions. Had he known that parcels of *genuine* butter, sometimes amounting to several tons, are occasionally offered as low as 7*d.* per lb. in wholesale markets, this erroneous preconception would not have been formed. I have eaten butter made in some of the primitive peasant-dairies of the North of Europe, which if imported to this country would not sell at so good a price as "P. Y. C." (Petersburgh yellow candle) tallow. It was perfectly genuine and detestably nauseous, but nevertheless was highly relished by the people who made it, and to whom it forms a staple article of food, especially in winter. Such butter is occasionally shipped to England from Kiel and other Northern ports; also from Canada and Australia, and sells at ruinous prices; the merchants who send it being unacquainted with the fastidiousness of English palates, and supposing that what is eaten in their own country will be eaten here.

It is the choice brands of "fresh" butter that are the most adulterated, and those delicately-constituted people who cannot eat salt butter, but insist upon having fresh grass butter in the midst of winter when no grass is growing, are abundantly regaled with refined mutton suet, P. Y. C. tallow, candle ends, and kitchen stuff which, when skilfully prepared, churned up with a little milk and sugar and prettily rolled, moulded or packed in rustic-looking baskets, sells at 2*s.* per lb. in the west-end, and progressively down to 1*s.* 8*d.* or 1*s.* 6*d*, proceeding further eastward.

Knowing that this class of butter is systematically adulterated at this season with refined fats, you may judge of my respect for the skill of the public analysts when I find that it has escaped the prosecutions that have fallen so heavily upon the cheap butters. Taking the facts as they have come out in these prosecutions, it appears that *at present* chemical analysis fails to distinguish between the fat which is excreted from the udder of the cow, and that which is deposited in the tissues of the same animal or of the sheep, provided both are mechanically prepared in a similar manner and flavoured with a little sugar and caseine. I may possibly be wrong in this conclusion, and therefore propose a test which may be used to decide this question. Let samples be made and certified by first churning pure milk, then mixing such churnings with varying proportions of foreign fats prepared as those manufacturers can, who have converted their soap-boiling into butter-frying plant, and let such samples be sent to Mr. Muter, or any other expert who believes himself able to certify to the purity or impurity of butter. If he can determine the *percentage* of foreign fat in such varied mixtures his future certificates will have considerable value and authority.

W. MATTIEU WILLIAMS

Science in Hastings

I HAVE just seen your comments (vol. xiii. p. 217) on a letter that appeared a few weeks ago in the Hastings and St. Leonards *News*, and at once write to vindicate the honour of Hastings. We have a Philosophical and Historical Society, a Literary and Scientific Institution, and a Mechanics' Institution, besides two or three others of a more private character. A museum we certainly do not possess, and if it should prove like most *local?* museums, a collection of "et cetera," trying to rival the British Museum in the extent of its field of research, and an overturned workbox as to arrangement, the longer we are without it the better. Far be it from me to say that the people of Hastings and St. Leonards display as much interest as they ought in the pursuit of science, but still they are not so bad as you make out. The Philosophical Society, in which I am chiefly interested, and of which I enclose last year's report, has done much good work in bygone days, but owing to a variety of circumstances it is not at present quite so flourishing as we could wish. However, I am glad to say that at the last Council meeting it was decided to publish a pamphlet containing a list of the specimens in the various branches of Natural History to be found about the neighbourhood, both on the land and in the sea. This will be but a commencement, and will be distributed among the inhabitants and visitors with a request that a notice of any alterations or additions should be sent to the Society for future publication. Thus it is hoped that fresh interest will be awakened.

My own idea is that our failure arises from a multiplicity, not a paucity of institutions, and that their aims are too high. I believe one good institution would be far better than all the separate ones. Thus we have the Literary Institution, subscription twenty-five shillings a year. This is in the old part of the town, and formerly possessed the museum and a good set of meteorological instruments. The only privileges members have are the reading room and a good standard library, which, however, has hardly been added to for some years. Next we come to the Philosophical Society, subscription 10*s.* 6*d.* a year. This certainly tries to do something, for there are papers read on various subjects, and each session concludes with a conversazione. But in my opinion its weak point is that the majority of papers read have no local bearing. I acknowledge that many display great ability, but the chief aim of such a Society should be the collection and description of subjects connected with *local* natural history, botany, climate, archæology, geology, &c., and wider researches should be left for other more suitable societies, or for special occasions now and then. The Mechanics' Institution I believe is getting on pretty well. There is a reading room, with a library, and lectures are delivered on all imaginable subjects.

If these three institutions could unite, instead of being to a certain extent antagonistic to each other, great advantage, I am sure, would accrue to the members and science generally, although none but those who have gone into the question can imagine the difficulties that would have to be overcome before a harmonious union could be effected.

The Science and Art class to which you refer has recently been organised, and is said to be answering very well.

There is, however, a possibility that this state of things will be soon partly altered, for rumours are afloat that our excellent member, Mr. Brassey, has offered to provide a suitable building in which all the local societies will have apartments, but no particulars are yet known.

Hastings, Jan. 28 ALEX. E. MURRAY

P.S.—Since writing the above I remember that I have omitted the Athenæum, but as this is mainly a debating society it has little to do with the advance of science.

OUR ASTRONOMICAL COLUMN

THE TOTAL SOLAR ECLIPSE OF 1876, SEPT. 17–18.—The track of totality in this eclipse is wholly upon the Pacific Ocean, and in such course that only two or three small islands or reefs appear to be situate near the central line. Using the *Nautical Almanac* elements, which are almost identical with those of the American Ephemeris, wherein the moon's place is derived from Peirce's Tables, St. Matthias Island, west of Admiralty Islands off the north-east coast of New Guinea, is traversed by the central track of the shadow, with the sun at an altitude of 5° at 6h. 16m. A.M. on the 18th local time. Thence skirting Ellice Islands it passes between the Fiji's and the Samoan or Navigator group to Savage Island, in 170° west of Greenwich, latitude 19° south, which is apparently the only spot where totality may be witnessed under anything like favourable conditions, and even here the duration of totality is less than one minute. The after course of the central line does not encounter any land.

In the northern of the two large islands of the Fiji group (Vanua Levu) 179° east, a partial eclipse will occur commencing at 7h. 47m. A.M. local time 44° from the sun's north point towards the west for direct image, and ending at 10h. 16m., magnitude 0·86. In the larger island of the Navigator group, Savaii, of the Admiralty Chart, there will also be a partial eclipse, though nearly approaching totality; eclipse begins 8h. 23m. A.M. at 53° from the sun's north point towards the west, and ends at 11h. 2m., magnitude 0·97.

Assuming the north point of Savage Island to be in 169° 48′ W., with 18° 55′ south latitude, a direct calculation gives a total eclipse commencing at 10h. 8m. 6s. A.M. local mean time, and continuing 57 seconds with the sun at an altitude of 58°; the first contact of the moon with the sun's limb at 8h. 48m. A.M., 49° from his north point towards west for direct image, and the end of the eclipse at 11h. 29m.

In New Zealand the eclipse attains a magnitude of about 0·5 at Auckland, greatest phase at 9h. 18m. A.M.; towards the extremity of the southern island about Otago, one-third of the sun's diameter will be obscured about 9h. 12m. local time. A partial eclipse between similar limits will be visible on the east coast of Australia and in Van Diemen's Land.

MINOR PLANETS.—The long period of revolution assigned to No. 153, *Hilda*, by the early calculations has been confirmed by a new determination of the elements by Herr Kühnert, of Vienna, upon more than eight weeks' observations. The orbit is as follows:—

Mean Longitude, 1875, Dec. 19, at Berlin noon	34° 58′·7
Longitude of perihelion	285° 1′·6
„ „ ascending node	228° 20′·5
Inclination to ecliptic	7° 50′·9
Excentricity	0·16311
Mean diurnal motion	451″·91
Semi-axis major	3·9504

Hence the period of sidereal revolution is 2,868 days, or 7·85 years.—For No. 158 detected at Berlin on Jan. 4, Dr. Maywald, who has been so long occupied in computations connected with the minor planets, has proposed the name "Koronis."—No. 155, discovered by Palisa at Pola on Nov. 8, has so far been observed only on four nights, and these observations being at intervals which render them unavailable for calculation of elliptical elements, it appears not unlikely that it will be lost, as are already several minor planets similarly circumstanced, unless an effort be made to recover it with the aid of circular elements in the next period of absence of moonlight, and with some one of the larger telescopes; it was not brighter than a star of the twelfth magnitude at discovery, and must now be considerably fainter.—The period of revolution of No. 150 by seven weeks' observations is 1,879½ days.

M. Paul Henry, of the Observatory of Paris, announces his discovery of No. 159 on Jan. 26.

THE SECOND COMET OF 1702.—A complete reduction and discussion of the observations of this comet, taken at Rome by Bianchini and Maraldi, does not afford indications of elliptical motion, as might be surmised to exist from the small inclination of the orbit to the ecliptic and the direct movement. In fact, these observations appear to be by no means precise, and the differences from calculation *inter se* are too irregular to afford any hope of sensibly improving upon the orbit given by Burckhardt. Considering that the differences of right ascension between the comet and comparison stars were taken by means of clocks, and the differences of declination measured by a micrometer scale, the arc value of which was determined by observation of the sun's diameter, rather better places might have been looked for. The following are the errors given by Burckhardt's orbit, as compared with the newly reduced positions in which aberration and parallax have been taken into account:—

1702, April	20	Δλ. cos. β	...	+ 7′·2	Δβ ...	− 1′·2
„	„ 21	„	...	− 1·6	„ ...	− 6·1
„	„ 26	„	...	− 1·4	„ ...	− 1·8
„	„ 27	„	...	− 3·5	„ ...	+ 2·4
„	May 2	„	...	+ 9·1	„ ...	− 3·1
„	„ 4	„	...	− 7·6	„ ...	− 3·6

The comet was at its least distance from the earth on the night of April 19, when it approached our globe within 0·0438 of the earth's mean distance from the sun.

PROF. TYNDALL ON GERMS*

IN further illustration of the dangers incurred in this field of inquiry the author refers to the excellent paper of Dr. Roberts on Biogenesis, in the "Philosophical Transactions" for 1874. Dr. Roberts fills the bulb of an ordinary pipette to about two-thirds of its capacity with the infusion to be examined. In the neck of the pipette he places a plug of dry cotton-wool. He then hermetically seals the neck and dips the bulb into boiling water or hot oil, where he permits it to remain for the requisite time. Here we have no disturbance from ebullition, and no loss by evaporation. The bulb is removed from the hot water and permitted to cool. The sealed end of the neck is then filed off, the cotton-wool alone interposing between the infusion and the atmosphere.

The arrangement is beautiful, but it has one weak point. Cotton-wool free from germs is not to be found, and the plug employed by Dr. Roberts infallibly contained them. In the gentle movement of the air to and fro as the temperature changed, or by any shock, jar, or motion to which the pipette might be subjected, we have certainly a cause sufficient to detach a germ now and then from the cotton-wool which would fall into the infusion and produce its effect. Probably, also, condensation occurred at times in the neck of the pipette; the water of condensation carrying back from the cotton-wool the seeds of life. The fact of fertilisation being so rare as Dr. Roberts found it to be is a proof of the care with which

* On the Optical Deportment of the Atmosphere in reference to the Phenomena of Putrefaction and Infection. Abstract of a paper read before the Royal Society, January 13th, by Prof. Tyndall, F.R.S. (Communicated by the author.) Continued from p. 254.

his experiments were conducted. But he did find cases of fertilisation after prolonged exposure to the boiling temperature; and this caused him to come to the conclusion that under certain rare conditions spontaneous generation may occur. He also found that an alkalised hay-infusion was so difficult to sterilise that it was capable of withstanding the boiling temperature for hours without losing its power of generating life. The most careful experiments have been made with this infusion. Dr. Roberts is certainly correct in assigning to it superior nutritive power. But in the present inquiry five minutes boiling sufficed to completely sterilise the infusion.

Summing up this portion of his inquiry, the author remarks that he will hardly be charged with any desire to limit the power and potency of matter. But holding the notions he does upon this point, it is all the more incumbent on him to affirm that as far as inquiry has hitherto penetrated, life has never been proved to appear independently of antecedent life.

Though the author had no reason to doubt the general diffusion of germs in the atmosphere, he thought it desirable to place the point beyond question. At Down, Mr. Darwin, Mr. Francis Darwin; at High Elms, Sir John Lubbock; at Sherwood, near Tunbridge Wells, Mr. Siemens; at Pembroke Lodge, Richmond Park, Mr. Rollo Russell; at Heathfield Park, Messrs. Hamilton; at Greenwich Hospital, Mr. Hirst; at Kew, Dr. Hooker; and at the Crystal Palace, Mr. Price, kindly took charge of infusions, every one of which became charged with organisms. To obtain more definite insight regarding the diffusion of atmospheric germs, a square wooden tray was pierced with 100 holes, into each of which was dropped a short test-tube. On Oct. 23, thirty of these tubes were filled with an infusion of hay, thirty-five with an infusion of turnip, and thirty-five with an infusion of beef. The tubes, with their infusions, had been previously boiled, ten at a time, in an oil-bath. One hundred circles were marked on paper so as to form a map of the tray, and every day the state of each tube was registered upon the corresponding circle. In the following description the term "cloudy" is used to denote the first stage of turbidity; distinct but not strong. The term "muddy" is used to denote thick turbidity.

One tube of the 100 was first singled out and rendered muddy. It belonged to the beef group, and it was a whole day in advance of all the other tubes. The progress of putrefaction was first registered on Oct. 26; the "map" then taken may be thus described:—

Hay.—Of the thirty specimens exposed one had become "muddy"—the seventh in the middle row reckoning from the side of the tray nearest the stove. Six tubes remained perfectly clear between this muddy one and the stove, proving that differences of warmth may be overridden by other causes. Every one of the other tubes containing the hay infusion showed spots of mould upon the clear liquid.

Turnip.—Four of the thirty-five tubes were very muddy, two of them being in the row next the stove, one four rows distant, and the remaining one seven rows away. Besides these six tubes had become clouded. There was no mould on any of the tubes.

Beef.—One tube of the thirty-five was quite muddy, in the seventh row from the stove. There were three cloudy tubes, while seven of them bore spots of mould.

As a general rule organic infusions exposed to the air during the autumn remained for two days or more perfectly clear. Doubtless from the first germs fell into them, but they required time to be hatched. This period of clearness may be called the "period of latency," and indeed it exactly corresponds with what is understood by this term in medicine. Towards the end of the period of latency, the fall into a state of disease is comparatively sudden; the infusion passing from perfect clearness to cloudiness more or less dense in a few hours.

Thus the tube placed in Mr. Darwin's possession was clear at 8.30 A.M. on Oct. 19, and cloudy at 4.30 P.M. Seven hours, moreover, after the first record of our tray of tubes, a marked change had occurred. It may be thus described:—Instead of one, eight of the tubes containing hay-infusion had fallen into uniform muddiness. Twenty of these had produced Bacterial slime, which had fallen to the bottom, every tube containing the slime being covered by mould. Three tubes only remained clear, but with mould upon their surfaces. The muddy turnip-tubes had increased from four to ten; seven tubes were clouded, while eighteen of them remained clear, with here and there a speck of mould on the surface. Of the beef, six were cloudy and one thickly muddy, while spots of mould had formed on the majority of the remaining tubes. Fifteen hours subsequent to this observation, viz. on the morning of Oct. 27, all the tubes containing hay-infusion were smitten, though in different degrees, some of them being much more turbid than others. Of the turnip-tubes, three only remained unsmitten, and two of these had mould upon their surfaces. Only one of the thirty-five beef-infusions remained intact. A change of occupancy, moreover, had occurred in the tube which first gave way. Its muddiness remained grey for a day and a half, then it changed to bright yellow green, and it maintained this colour to the end. On the 27th every tube of the hundred was smitten, the majority with uniform turbidity; some, however, with mould above and slime below, the intermediate liquid being tolerably clear. The whole process bore a striking resemblance to the propagation of a plague among a population, the attacks being successive and of different degrees of virulence.

From the irregular manner in which the tubes are attacked, we may infer that, as regards *quantity*, the distribution of the germs in the air is not uniform. The singling out, moreover, of one tube of the hundred by the particular *Bacteria* that develop a green pigment, shows that, as regards *quality*, the distribution is not uniform. The same absence of uniformity was manifested in the struggle for existence between the *Bacteria* and the penicillium. In some tubes the former were triumphant; in other tubes of the same infusion the latter was triumphant. It would seem also as if a want of uniformity as regards *vital vigour* prevailed. With the self-same infusion the motions of the *Bacteria* in some tubes were exceedingly languid, while in other tubes the motions resembled a rain of projectiles, being so rapid and violent as to be followed with difficulty by the eye. Reflecting on the whole of this, the author concludes that the germs float through the atmosphere in groups or clouds, with spaces more sparsely filled between them. The touching of a nutritive fluid by a Bacterial cloud would naturally have a different effect from the touching of it by the interspace between two clouds. But as in the case of a mottled sky, the various portions of the landscape are successively visited by shade, so, in the long run, are the various tubes of our tray touched by the Bacterial clouds, the final fertilisation or infection of them all being the consequence. The author connects these results with the experiments of Pasteur on the non-continuity of the cause of so-called spontaneous generation, and with other experiments of his own.*

On the 9th of November a second tray containing one hundred tubes filled with an infusion of mutton was exposed to the air. On the morning of the 11th six of the

* In hospital practice the opening of a wound during the passage of a Bacterial cloud would have an effect very different from the opening of it in the interspace between two clouds. Certain caprices in the behaviour of dressed wounds may possibly be accounted for in this way. Under the heading "Nothing new under the Sun," Prof. Huxley has just sent me the following remarkable extract:—"Uebrigens Kann man sich die in der Atmosphäre schwimmenden Thierchen wie Wolken denken, mit denen ganz leere Luftmassen, ja ganze Tage völlig reinen Luftverhältnisse wechseln." (Ehrenberg, "Infusions Thierchen," 1838, p. 525.) The coincidence of phraseology is surprising, for I knew nothing of Ehrenberg's conception. My "clouds," however, are but small miniatures of his.

ten nearest the stove had given way to putrefaction. Three of the rows most distant from the stove had yielded, while here and there over the tray particular tubes were singled out and smitten by the infection. Of the whole tray of one hundred tubes, twenty-seven were either muddy or cloudy on the 11th. Thus, doubtless, in a contagious atmosphere, are individuals successively struck down. On the 12th all the tubes had given way, but the differences in their contents were extraordinary. All of them contained *Bacteria*, some few, others in swarms. In some tubes they were slow and sickly in their motions, in some apparently dead, while in others they darted about with rampant vigour. These differences are to be referred to changes in the germinal matter, for the same infusion was presented everywhere to the air. Here also we have a picture of what occurs during an epidemic, the difference in number and energy of the Bacterial swarms resembling the varying intensity of the disease. It becomes obvious from these experiments that of two individuals of the same population, exposed to a contagious atmosphere, the one may be severely, the other lightly attacked, though the two individuals may be as identical as regards susceptibility as two samples of one and the same mutton infusion.

The author traces still further the parallelism of these actions with the progress of infectious disease. The *Times* of January 17 contained a remarkable letter on Typhoid Fever signed "M.D.," in which occurs the following remarkable statement:—"In one part of it (Edinburgh), congregated together and inhabited by the lowest of the population, there are, according to the Corporation return for 1874, no less than 14,319 houses or dwellings—many under one roof, on the 'flat' system—in which there are no house connections whatever with the street sewers, and, consequently, no water-closets. To this day, therefore, all the excrementitious and other refuse of the inhabitants is collected in pails or pans, and remains in their midst, generally in a partitioned-off corner of the living room, until the next day, when it is taken down to the streets and emptied into the Corporation carts. Drunken and vicious though the population be, herded together like sheep, and with the filth collected and kept for twenty-four hours in their very midst, it is a remarkable fact that typhoid fever and diphtheria are simply unknown in these wretched hovels."

This case has its analogue in the following experiment, which is representative of a class. On Nov. 30 a quantity of animal refuse, embracing beef, fish, rabbit, hare, was placed in two large test-tubes opening into a protecting chamber containing six tubes. On Dec. 13, when the refuse was in a state of noisome putrefaction, infusions of whiting, turnip, beef, and mutton were placed in the other four tubes. They were boiled and abandoned to the action of the foul "sewer gas" emitted by their two putrid companions. On Christmas-day the four infusions were limpid. The end of the pipette was then dipped into one of the putrid tubes, and a quantity of matter comparable in smallness to the pock-lymph held on the point of a lancet was transferred to the turnip. Its clearness was not sensibly affected at the time; but on the 26th it was turbid throughout. On the 27th a speck from the infected turnip was transferred to the whiting; on the 28th disease had taken entire possession of the whiting. To the present hour the beef and mutton tubes remain as limpid as distilled water. Just as in the case of the living men and women in Edinburgh, no amount of fetid gas had the power of propagating the plague, as long as the organisms which constitute the true contagium did not gain access to the infusions.

The universal prevalence of the germinal matter of *Bacteria* in water has been demonstrated with the utmost evidence by the experiments of Dr. Burdon Sanderson. But the germs in water are in a very different condition, as regards readiness for development, from those in air. In water they are thoroughly wetted, and ready, under the proper conditions, to pass rapidly into the finished organism. In air they are more or less desiccated, and require a period of preparation more or less long to bring them up to the starting-point of the water-germs. The rapidity of development in an infusion infected by either a speck of liquid containing *Bacteria* or a drop of water is extraordinary. On Jan. 4 a thread of glass almost as fine as a hair was dipped into a cloudy turnip infusion, and the tip only of the glass fibre was introduced into a large test-tube containing an infusion of red mullet. Twelve hours subsequently the perfectly pellucid liquid was cloudy throughout. A second test-tube containing the same infusion was infected with a single drop of the distilled water furnished by Messrs. Hopkin and Williams; twelve hours also sufficed to cloud the infusion thus treated. Precisely the same experiments were made with herring with the same result. At this season of the year several days' exposure to the air are needed to produce so great an effect. On Dec. 31 a strong turnip-infusion was prepared by digesting thin slices in distilled water at a temperature of 120° F. The infusion was divided between four large test-tubes, in one of which it was left unboiled, in another boiled for five minutes, in the two remaining ones boiled, and after cooling infected with one drop of beef-infusion containing *Bacteria*. In twenty-four hours the unboiled tube and the two infected ones were cloudy, the unboiled tube being the most turbid of the three. The infusion here was peculiarly limpid after digestion; for turnip it was quite exceptional, and no amount of searching with the microscope could reveal in it at first the trace of a living Bacterium; still germs were there which, suitably nourished, passed in a single day into Bacterial swarms without number. Five days have not sufficed to produce an effect approximately equal to this in the boiled tube, which was uninfected but exposed to the common laboratory air.

There cannot, moreover, be a doubt that the germs in the air differ widely among themselves as regards *preparedness* for development. Some are fresh, others old; some are dry, others moist. Infected by such germs the same infusion would require different lengths of time to develop Bacterial life. This remark applies to and explains the different degrees of rapidity with which epidemic disease acts upon different people. In some the hatching-period, if it may be called such, is long, in some short, the differences depending upon the different degrees of preparedness of the contagium.

The author refers with particular satisfaction to the untiring patience, the admirable mechanical skill, the veracity in thought, word, and deed displayed throughout this first section of a large and complicated inquiry by his assistant, Mr. John Cottrell, who was zealously aided by his junior colleague, Mr. Frank Valter.

NOTE. *Jan.* 31.—The notion that the author limited himself to temperatures of 60° and 70° Fahr. is an entire misconception. But more of this anon.

THE OCCURRENCE AND MANUFACTURE OF FLINT SKIN-SCRAPERS FROM NEW JERSEY, U.S.A.

A REMARKABLE feature of the common Indian relics found in Central New Jersey is the very great abundance of "skin-scrapers," as one form of stone implements is everywhere known; and the great care that has evidently been bestowed upon them in the making equally attracts the attention when a series of these implements is examined. That a flint implement used in the preparation of skins for clothing and tent-covering should require as much care in its manufacture as an arrow-point, does not seem probable, and one would naturally expect to find in a scraper simply a comparatively

dull rubbing edge given to a conveniently sized pebble. Such, however, is seldom or never the case, and the class of implements, to which is given the above name, are as marked in their several peculiarities as is any form of stone implement with which we are familiar.

Having remarked the great abundance of these relics, I desire here more particularly to notice several specimens which are of more than ordinary interest. The illustrations 1, 2, 3, and 4, are figures of the very smallest scrapers that I have seen; and what is more remarkable than their small size is the beauty of their finish and their symmetry. They are made of differently coloured jasper, were not found together or in the same neighbourhood, showing that they had different origins, and are not ex-

FIG. 1.

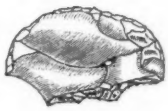

FIG. 2.

amples of the fancy of some eccentric chipper of flint implements, such as sometimes occur in masses of broken specimens and flakes that indicate the former site of an arrow-maker's labours.

Not one of these four small scrapers appears to be simply a flake, originally of this shape and subsequently chipped at the scraping edge; but the entire surfaces have undoubtedly been carefully wrought, and show that a small mass of the mineral has been worked to the shape and finish of the specimens, as now found. A quite common form of scraper is the base of an arrow or spear point which has been utilised by subsequently chipping the fractured end, so as to give it a bevelled edge; but the specimens here figured cannot be classed with these, inasmuch as there is nothing suggestive of the arrow-point in their present shape, and unlike them, these four specimens have the under side smooth and slightly concave, a feature not found in the "made over" arrow-heads.

Having seen that so much care was expended on these small scrapers, it is quite certain that these implements were put to some important use, but exactly what, it is difficult to determine. Certainly, in the dressing of the skins of our larger mammals they could be of no use, and of but little even when the skins of the smallest, such as squirrels, were used, which was probably seldom the case, as the larger quadrupeds were as easily obtained. The

FIG. 3.

FIG. 4.

skins of birds, if used as ornaments, would not need scraping to make them pliable; and I can only suggest that from the fact of having found traces of bone beads, in graves, made from sections of the long bones of wading birds, I have thought it probable that these small scrapers were used in rounding off the ends of such bone beads; and they might also have been used in the shaping and sharpening of the beautiful bone fish-hooks our aborigines were accustomed to make. Such uses would, of course, make the name "skin-scraper" inappropriate, as I am quite disposed to think it is.

Fig. 5 represents a very perfect specimen of the spoon-shaped scrapers, such as are common in Europe, and by no means rare in the United States. Those found here, as a rule, are not so symmetrical as the specimen figured, and do not have the "bowl" or concave portion of the spoon so decidedly marked. Our New Jersey specimens have this under-surface generally plain, or but slightly concave; and uniform with the stem or handle of the implement. In the specimen figured this is not the case, and the spoon-shape is so pronounced as to suggest that it is a veritable spoon.

Fig. 5 has been chipped from a very pretty agate pebble, such as occur in the gravelly bed of the upper waters of the Delaware River; and it is an interesting

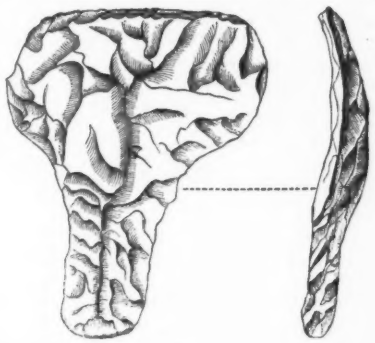

FIG. 5.

fact connected with this class of relics, that the majority are made of jasper, agate, and quartz, minerals the most difficult to shape, and certainly no better adapted to the ordinary uses of these implements—that of scraping the fat from skins.

One word in conclusion. Mr. C. C. Jones, jun., in his work on the "Antiquities of the Southern Indians," writes, under the head of "Scrapers," that "the spoon-shaped scraper of France and Switzerland is more pronounced in form and purpose than any implement of like character it has been my good fortune to find among the relics of the southern tribes."

It is curious that so much variation in the forms of their stone implements should exist in tribes nearly related, and but a few hundred miles apart. Judging from the specimens figured by the author quoted, scrapers were quite simple in their shape and finish; which, as we have seen, is the opposite of what we find in New Jersey, where as great a variety in shapes and sizes occur as exist in the various patterns of arrow-points. *

CHARLES C. ABBOTT

Trenton, New Jersey

THE RECENT BUTTER CASE

AS the case in connection with the Adulteration Act which we discussed in a leading article last week is of considerable importance, both from a scientific and a public point of view, we think it well to put the facts before our readers.

The following summary of the analytical results detailed in Court by the different chemists has been supplied us from a verbatim report of the proceedings before the magistrate at Southwark Police Court.

These results were given after the magistrate's decision had been delivered. They were entirely informal, and took the shape of a discussion, in which everyone appeared to act as his own counsel, and no attempt was made to establish or trace the identity of the samples.

* As authority for applying the term "scraper" to implements similar to Fig. 5, permit me to quote the late Prof. Jeffries Wyman ("Fifth Annual Report of Peabody Museum," 1872, p. 27). He writes, "The term scraper is applied to some of the implements just referred to (a collection from the author), because of their close resemblance to such as bear the same name from the Danish collections belonging to the Museum. They are characterised by having a circular or semi-circular flattened head, with a short projection which might serve as a handle, or for the purpose of attaching one. They differ from the Danish implements chiefly in their much smaller size."

Dr. Muter's analysis—

Water	=	15·00 per cent.
Salt	=	3·96 " "
Curd	=	2·14 " "
Foreign fat	=	55·2 " "
Butter fat	=	23·7 " "

The fat was thus made up of 30 per cent. of butter fat and 70 per cent. foreign fats. The fat had a melting point below that of butter, and yielded 93·3 per cent. of fatty acids. When examined by the microscope the butter was found to contain fat in a crystalline state, and the so-called curd consisted of vegetable matter, which was described as parenchyma. Finally, the butter was stated to be but slightly rancid.

Dr. Muter said that his standard for genuine butter was 88 per cent. of fatty acids.

Dr. Muter, who appears to have had sufficient of his sample to supply several of his friends, was supported in Court by his assistant Mr. De Konigh, Dr. Dupré, Mr. Wigner, and a microscopist.

Dr. Dupré and Mr. Wigner's Results.—Dr. Dupré found in the fat 94·05 per cent. and Mr. Wigner 94·20 per cent. fixed fatty acids, and the melting-point of the fat 4° C. below that of genuine butter. On a microscopic examination of the butter, both found crystals of fat, which indicated that it had been fused. They also stated that the butter was practically free from rancidity.

Dr. Dupré was of opinion, from the results of his analysis, that there was a doubt whether the sample contained any butter at all; and Mr. Wigner considered that if it contained any butter-fat the quantity must be small, but indeed he thought it was foreign fat simply flavoured with caproic acid. He further stated that his standard for pure butter was 87·5 per cent. fatty acids.

Somerset House Results.—The portion of the sample retained by the inspector, and referred by the magistrate to Somerset House for analysis, weighed about 45 grammes, and it was stated that the experiments performed were not only of an exhaustive character, but were repeated in most instances.

The chemists there found as follows:—

Water	=	9·83 per cent.
Salt	=	3·70 "
Curd	=	0·93 "
Fat	=	85·54 "

The fat gave a melting point of 33·3° C., a density of ·9053 at 100° Fahr., and yielded 88·7 per cent. fatty acids, the latter being seven-tenths above Dr. Muter's standard.

The butter was found to be very rancid, and this rancidity would account for the slight excess of fixed fatty acids, it having been found by actual experiment that butter depreciates by exposure, and that there is a corresponding increase of the fixed fatty acids found in the fat.

On a microscopic examination the butter was found to be free from crystals of fat, and the only foreign substances present were a few particles of impurities consisting of hard wood and cotton thread.

The following are the results of the analysis of the fat of an article corresponding to "butterine," which was referred to in Court as having been examined in exactly a similar way as the sample in dispute:—

Fatty acids, 93·32 per cent., melting-point, 25° C., and density of fat at 100° F. = ·90108.

The processes followed by the different chemists for the analysis of the samples differed but little, but the chemists at Somerset House adopted an additional safeguard against error in saponifying the fats, by taking the density of the fat in the sample at a temperature of 100° F.

The melting-point, the density of the fat, and the quantity of fixed fatty acids were clearly shown to be in complete accord, and these three results are certainly most important in their direct bearing on the accuracy of the analysis.

NATURAL HISTORY OF ST. HELENA

THE following extracts from a letter addressed to Dr. Hooker by Mr. Wollaston, who has been residing for some months in St. Helena for the purpose of investigating the insect fauna, can hardly fail to be interesting to students of geographical distribution:—

"Plantation House, St. Helena, Nov. 22, 1875

"At this season of the year it is extremely difficult to obtain seeds, for the genuine native plants which are still not extinct, in addition to being extremely few in number, nearly all grow in places very difficult of access at a time when the upper ridges are nearly always covered with cloud, and only a certain proportion of them are showing any signs of active life (in the shape of flowers and seeds); but I have been able to collect three out of the four species of cabbage-trees, a *Lobelia*, two or three Wahlenbergias, and (best of all) the extremely rare *Aster* (or *Commidendron*) *Burchellii*. This last is, I think, as nearly extinct as anything still living can be. Mr. Melliss says there is only one plant of it in the island; but in that he is wrong, for we counted two or three, in full blossom, in the same grove of the *Aster gummiferus*, in which he records the existence of his single individual. We have, however, seen it nowhere else, and it is decidedly on its last legs. Even the *A. gummiferus* is excessively rare, and I shall hope to get you seeds of it before we leave the island; as well as of the *Commidendron robustum* (the true 'gum-wood'). . . . The *A. Burchellii* is so rare that I have been drying you a few specimens, feeling that (as it may soon be gone altogether if we cannot persuade the islanders to spare it from their donkey-loads of firewood) you might, perhaps, like some fresh ones. . . .

"The insect flora, although so extremely limited that I have not in nearly even three months collected more in Coleoptera than 150 species, still continues to keep up its character for eccentricity—ringing the changes on some half a dozen types (chiefly Rhyncophorous) to a marvellous extent. We seem indeed never to exhaust them, turning up new species almost every time that we can secure a hard day's work on the *Compositæ* ridge. Having ultimately to work them out, I take scores of specimens, and must have mounted carefully some six or seven thousand already." T. D.

NOTES

THE following are the proposed movements of H.M.S. *Challenger*:—She was to leave Valparaiso on Dec. 10, and arrive at the Falkland Isles on Jan. 10; leave on Feb. 6, arrive at Monte Video Feb. 18; leave Feb. 28, arrive at Tristan d'Acuhna March 20; leave March 21, arrive at Ascension April 7; leave April 14, arrive at St. Vincent May 5; leave May 12, and arrive in England June 12.

THE Senior Wrangler in this year's Cambridge Mathematical Tripos is Mr. Joseph Timmis Ward, of St. John's, son of the late Mr. Henry Ward, of Banbury. He was educated at Rochester Cathedral Grammar School, under the Rev. R. Whiston. Mr. William L. Mollison, of Clare, the Second Wrangler, is a native of Aberdeen, and is the son of Mr. W. Mollison, of that town. He was educated at the Grammar School and University of Aberdeen.

WE would call attention to the advertisement in to-day's NATURE by the Kew Committee, offering to the public greater facilities for the verification of instruments than have hitherto existed at Kew.

WE understand that the eminent ornithologist, Dr. G. Hartlaub, of Bremen, has in preparation a new work on the Birds of Madagascar. This will be a considerable undertaking, as since

the publication of Dr. Hartlaub's last work on this subject ("Ornithologischer Beitrag zur Fauna Madagascars," Bremen, 1861), great additions have been made to our knowledge of the ornithology of this wonderful island by the investigations of Pollen, Van Dam, Grandidier, Crossley, and other naturalists.

DR. O. FINSCH, of Bremen, and Alfred Brehm—both well-known German naturalists—will accompany the scientific expedition to the Obi (Northern Siberia), which is to start in March next.

THE Museum of Bremen, founded by a private society of merchants, and well known to ornithologists of all countries from the rarity of many of the specimens and the excellent manner in which they are mounted, will shortly become the property of the City of Bremen. It is said that Dr. O. Finsch is likely to be appointed its first director under the new *régime*. We may add that no more eligible selection could be made.

NEW ZEALAND papers just to hand report an interesting discovery of moa bones in that colony farther north than any have previously been found. No remains of the extinct bird having been discovered north of the town of Auckland; the moa region was supposed to have lain altogether to the south of that place. The advices now received, however, state that numerous bones, representing the skeletons of fifteen moas, have been found along the beach for many miles north of Whangarei Heads, sixty miles to the north of Auckland. The discoverers were Mr. George Thorne, and Mr. Kirk, the Secretary of the Auckland Institute. With the moa bones were discovered several human skulls and a complete human skeleton in a sitting posture (the position in which it was usual to bury Maoris); also many large pebbles, such as the moa was in the habit of swallowing with its food, a rude stone hatchet, and some chips of obsidian. The spot where the remains were discovered was at one time covered with vegetation, but this having been burned by bush fires the ground had been covered by drifting sand, the disturbance of which by the wind has exposed the bones. The natives in the district had no knowledge whatever of the existence of any of the remains discovered, whose antiquity is believed to be considerable. Further researches in the same locality may possibly be productive of interesting results.

A LETTER from M. Alluard, the director of the Puy de Dôme Observatory, has been published in the *International Bulletin* of Jan. 29, intimating that the establishment is now in full operation. M. Alluard has ascended the mountain for the purpose of taking instruments to the observers on the top. The elevation is about 6,000 feet above the level of the sea. It was on the top of the Puy de Dôme that, in 1647, Perier, the brother-in-law of Pascal, verified the fact, discovered at Paris, that pressure diminishes with the altitude. The first experiments were made by Pascal himself on the top of St. Jacques la Boucherie, whose height is about ninety feet. A statue of Pascal was placed on the basement of the tower about 1862, when occurred the second centenary of his death. The top of the Puy de Dôme is to be connected by a telegraphic wire with the Clermont Academy of Sciences, so that observations may be recorded daily and sent by telegram to every station in correspondence with the International Service.

AT the Court of Common Council last week Sir Charles Reed presented a resolution of the Committee for managing the Gresham College Trusts, of which Committee Sir Charles is a member, and Lord Selborne Chairman. Sir Charles gave a brief history of the institution, which, as our readers may surmise, was a record of decay and misappropriation. Sir Charles's motion, which was agreed to, was that the Gresham Committee (City side) be authorised to put themselves in communication with the Charity Commissioners, with the view of effecting the objects contemplated. In 1867 the Gresham Committee was advised by counsel that the only satisfactory solution of the difficulty would be found in the agreement of the Corporation and the Mercers Company to propound a scheme for the sanction of Parliament. That agreement has now happily been arrived at. We hope that Sir Charles's prediction will be realised, and that the result of the deliberations will be a scheme which will cause the College once more to represent the wishes of the founder in making it, what he originally designed it to be, a college for the furtherance and advancement of learning in London.

INTELLIGENCE received at Lisbon last week announced that Lieut. Cameron was almost completely restored to health. Baron Barth, the well-known German geographer, had arrived at Lisbon *en route* for Angola.

A REPORT by Drs. W. Elgar Buck and G. C. Franklin, on the Epidemic Diarrhœa of 1875 in Leicester, has been presented to the Sanitary Committee of that borough and printed. After a careful analysis of the whole facts, the authors show that Leicester is not an unhealthy town as regards the adult population; that the excessive rate of its infantile mortality, which really regulates the total mortality, is due to a "specific diarrhœa," eminently fatal, which prevails in July, August, and September; that such conditions, as are often assigned as causes of this destroyer of infant life, viz., early age or debility of parents, maternal neglect and debility, non-suckling, and opium-poisoning of infants exist in Leicester, as in other manufacturing towns, but have no appreciable effect in the main question at issue; and that the houses in which the fatal cases occur are not in themselves insanitary as regards size and number of rooms, water supply, ventilation and space, house drainage, and closet accommodation. The disease is not diffused equally among all classes of the community, the wealthy classes being wholly exempt from it as regards fatal results; and it is not the most densely-peopled districts, nor the poorest sections of the community in which the mortality is greatest; but the disease is most prevalent where the soil is water-logged, where sewers are liable to be blocked up, and where the houses have been built on undrained ground made up of refuse from all parts. In those districts of the town where these conditions exist in a less degree, the disease is less prevalent, and where they do not exist, the disease is almost wholly unknown. Drs. Buck and Franklin recommend, for the mitigation of the disease, that the subsoil be efficiently drained of its superfluous water, that a free outfall be found for the sewers, and that clay-pits or other excavations should not be filled up with filthy ash-bin refuse and then built upon. We hope that the authors of this suggestive Report will resume the inquiry next summer with the view of modifying or confirming the results they have arrived at, and of throwing further light on the history of this terrible epidemic, which every year almost assumes the magnitude of a pestilence among the infants of Leicester.

M. DE TOUCHIMBERT reports that in the district round Poitiers, the sowing of the winter cereals has been remarkably and very seriously interfered with, first by the drought which prevailed up to the close of October, and then by continuous rains for the first fortnight in November, followed by severe frosts during the rest of the month. Heavy storms of wind followed each other in succession on Nov. 9, 10, and 11, doing great damage to houses, and uprooting and otherwise destroying trees. Pneumonia and bronchitis have been peculiarly prevalent, owing probably to these violent alternations of drought, great humidity, and low temperature.

M. ALBERT LE BLEU, chief engineer of mines at Rodez, has visited the Paris Observatory to consult regarding the organisation of the Departmental Meteorological Commission, of which

he is president. The Commission proposes to apply the grant received from the Council-general to a thorough examination of the rainfall, the thunderstorms, and particularly the storms of hail in the different valleys of Aveyron. An anemometer is to be erected at the top of the cathedral. In developing the extremely difficult question of the issue of weather forecasts calculated to be practically useful to agriculturists, it is recognised that the essential conditions of success as regards the observers are sound sense, intimate knowledge of the physical features of the district, and shrewdness in interpreting weather signs, such as long residence in the locality alone can give, and that it is also essential to success to carry out a minute and extensive observation of the rainfall, thunderstorms, and storms of hail within and immediately surrounding the district to which the weather-warnings are sent.

MR. JAMES PATON, who for many years has been connected with the Museum of Science and Art, Edinburgh, has been appointed Curator of the Industrial Museum, Glasgow.

THE first general meeting of the Mineralogical Society of Great Britain and Ireland is held to-day at the Scientific Club, Saville Row, at 12 o'clock (noon), when the chair will be taken by Mr. H. C. Sorby, F.R.S. The first ordinary meeting will be held at the same place and time to-morrow, when a paper will be read on the Scottish Rhombohedral Carbonates, by Prof. M. Forster Heddle, M.D.

IT is proposed to establish a Technical College for Glasgow. In so far as the teaching of the textile department is concerned, the accomplishment of the scheme is all but assured.

As the Algerian Government have refused to take observations at eight o'clock in the morning, as in Europe, a Constantine newspaper, *Progrès de l'Est*, proposes to open a public subscription in order to send to France and England daily telegrams making known the state of weather in the colony. These weather telegrams are to be posted in the several hotels of Paris, London, Lyons, Marseilles, and other large cities, where intending tourists are likely to see them.

A SLIGHT earthquake was felt in Constantine, Algeria, at nine o'clock on the morning of Jan. 20. No damage was experienced. The duration was two seconds, and the shock vertical.

THE town of Abancay, in Peru, is reported to have been destroyed by an earthquake between 4 P.M. on the 4th and 9 A.M. on the 5th December. Thirty-seven shocks occurred, several very severe, with loss of life, the extent of which was not known.

BY decree of the French Government, a Chair of Physical Astronomy has been established in the Faculty of Science, Bourdeaux, to be filled by M. Rayet, and at Lyons a Chair of Industrial and Agricultural Chemistry, to be filled by M. Raulin.

TWO academies of medicine have been established by a decree of the President of the French Republic at Nantes and Marseilles.

PROF. TARGIONI has been appointed by the Italian Minister of Agriculture and Commerce Director of an Agrarian Entomological Station at Florence.

IN the *Brighton Observer*, which made its first appearance in its new form on Friday last, is a London letter on the scientific doings of the week. It appears to be the first of a series, in which it is intended to give, in a popular form, an account of the lectures and papers read before the societies which are likely to be of general interest. The idea is, we believe, a novel one, and we hope it will find favour with readers.

THE rockwork in the tanks at the new Westminster Aquarium contains a considerable amount of Portland oolite. We understand that it was purchased from the *débris* of the Colosseum, Regent's Park, as a sandstone, and it appears to have been introduced into salt and fresh tanks alike without investigation as to how far it is suitable. It perhaps may do no harm, but it would be well if anyone who has experience of what its effect will be would communicate his knowledge before any animals are placed in the tanks. There is, in addition, a good supply of Carboniferous limestone used, and in considering the conditions, it must be remembered that the water circulates constantly from tank to tank, so that the carbonate of lime will be just as present to all the inhabitants of the aquarium as to the Lamellibranchs and others it might benefit.

THE last-issued number of the publication of the Eastbourne Natural History Society contains a paper by Mr. Jenner on the Macro-Lepidoptera of East Sussex.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus erythræus*) from India, presented by Mr. T. O. Davis; a Black-faced Spider Monkey (*Ateles ater*) from Central America, two Green Turtles (*Chelone viridis*) from the West Indies, presented by Captain King; a Grey Ichneumon (*Herpestes griseus*) from India, presented by Mr. H. Churchill; a Common Curlew (*Numenius arquatus*), a Herring Gull (*Larus argentatus*), a Common Gull (*Larus canus*), two Black-headed Gulls (*Larus ridibundus*), European, presented by Mr. Charles Clifton.

THE LOAN EXHIBITION OF SCIENTIFIC APPARATUS

THE following is a list of the members of the Foreign Committees, the appointment of whom has been already notified to the Department of Science and Art:—

BELGIUM.—M. le Général Brialmont, M. Dewalque, M. le Général Liagre, M. Maus, M. Plateau, M. Schwann, M. Stas, M. Van Beneden.

FRANCE.—M. Alexre. Edmond Becquerel, M. Henri Marie Bouley, M. Gabriel Auguste Daubrée, M. Jean Louis Armand de Quatrefages De Breau, M. Jean Baptiste Dumas, M. Hervé Auguste Etienne Albans Faye, M. Edmond Fremy, M. Jules Célestin Jamin, M. Urbain Jean Joseph Le Verrier, Le Général Arthur Jules Morin, M. Eugène Melchior Peligot, M. Henri Edouard Tresca.

GERMANY.—I. *Berlin Committee.*—Dr. A. W. Hofmann, Dr. Beyrich, Dr. du Bois-Reymond, Dr. Dove, Dr. Förster, Dr. Hagen, T. G. Halkse, Dr. Hauchecorne, Dr. Helmholtz, Dr. Kiepert, Dr. G. Kirchhoff, Dr. Kronecker, Dr. C. D. Martius, Von Morozowicz, Dr. Neumayer, Dr. Reuleaux, Dr. Schellbach, Dr. W. Siemens, Dr. Virchow, Dr. C. H. Vogel, Dr. Websky.—II. *Committee representing other Cities and Towns of Germany.*—Dr. Von Babo, Dr. Beetz, Dr. Buff, Dr. Clausius, His Excellency Dr. Von Dechen, Dr. Von Fehling, Dr. Von Feilitzsch, Dr. Graebe, Dr. Von Groddeck, Dr. Heeren, Dr. Hittorf, Dr. Karsten, Kiel; Dr. Karsten, Rostoch; Dr. Knapp, Dr. Knoblauch, Dr. Kölliker, Dr. Kundt, Dr. Launhardt, Dr. Möhl, Dr. Poleck, Dr. Preyer, Dr. Von Quintus-Icilius, Dr. Reusch, Dr. Romberg, Dr. Rosenthal, Dr Serlo, Dr. C. Von Siemens, His Excellency Dr. Von Steinbeis, Dr. W. Weber, Dr. Wiedemann, Dr. Winkler, Dr. Wöhler, Dr. Wüllner, Dr. Zeuner, Dr. Zetzsche.

ITALY.—Prof. Blaserna, Prof. Cantoni, Prof. Respighi.

THE NETHERLANDS.—Prof. Dr. P. D. Rÿke, Prof. Dr. H. G. de Sande Bakhuyzen, Prof. C. H. D. Buys Ballot, Prof. J. Bosscha, Prof. Dr. F. C. Donders, F.R.S., Prof. J. W. Gunning, Prof. Dr. R. A. Mees, Prof. V. S. Van der Willigen, Dr. D. de Loos (Secretary).

SWITZERLAND.—Prof. E. Wartmann (President), Prof. J. Amsler Laffon, Prof. D. Colladon-Ador, Prof. Dr. F. A. Forel, Prof. Dr. E. Hagenbach-Bischoff, Prof. Ad. Hirsch, Prof. Albert Mousson, M. E. Sarasin-Diodati, Prof. L. Soret Colonel Gautier (Secretary.

PROF. NORDENSKJÖLD ON THE JENISEI

IN a letter from Prof. Nordenskjöld, of Stockholm, to Mr. Oscar Dickson, Prof. Nordenskjöld gives the following further details of his expedition.

In my preceding letters I narrated the progress of the Novaya Zemlya Jenisei Expedition up to the time when we, after a boat voyage of fifty to sixty Swedish miles, at Saostrowskoj on Aug. 31, fell in with the steamer *Alexander*, in which we afterwards journeyed 150 Swedish miles further up the Jenisei during a whole month to the town of Jeniseisk.

I proceed now to finish the account of my journey, with a short sketch of this steam voyage.

The *Alexander* was neither a passenger nor a cargo steamer, but formed a moveable warehouse propelled by steam, which was commanded not by seamen but by a friendly and affable merchant, who clearly did not much concern himself with the navigation of the vessel, but rather with trade and goods, and was seldom by the crew called "captain" but generally "hosain" (master). The arrangement of the vessel itself corresponded to this state of things. The whole of the fore-saloon was fitted up as a shop with shelves for goods along the walls, the usual desk, &c. The after-saloon was employed as a counting-house, writing and sleeping apartment for the master, and was besides filled to overflowing with wares of various kinds for sale, spirit casks, &c. There was thus no room for passengers, and at the first when we lay-to with the Swedish flag hoisted, our "hosain," Herr Ivan Michailovitsch Jarmenieff's reception of us was by no means specially friendly. He was even indisposed in the beginning to take us along with him. But no sooner had I, with the help of our pilot Teodor and a Swedish-Russian lexicon, succeeded in explaining to him what sort of people we were and what journey we had made, than all was completely changed, and from that moment we had in our "hosain" the most agreeable and obliging host we could desire. In order to make room for us on board, a cabin before the wheel-house, which had been filled with goods, was emptied and arranged for passengers. Its size was by no means great. During the night, for instance, we could only with difficulty lie alongside each other on a bedstead formed of boards, which took up nearly the whole cabin. Our men at first got places wherever they could, in the engine-room, where they were kindly entertained by the engineer. Afterwards we obtained another more roomy cabin, and our men got that which we had in the beginning.

The navigation of the vessel was managed by two mates, of a stately and original appearance, who, clothed in long caftans, each during his watch sat on a chair at the wheel, generally without steering, for the most part smoking a "papiross," and with the most unconcerned expression in the world exchanging jokes with those who were walking below. A man stood constantly in the fore part of the vessel, unceasingly trying the depth of the water with a long pole. In order to avoid the strong current of the deep central stream the course was taken not in the deepest part of the river, but as near the bank as possible, often so near that we could almost jump to land, and that our Nordland boat, which was towed alongside the steamer, was often drawn over land. The *Alexander* besides had in tow first one, afterwards two vessels (lodjor), nearly of the same size as the steamer itself, intended to receive the fish bought during the voyage, which was generally salted and prepared on board. The whole way between Jeniseisk and the sea there is not a single jetty, and on this account both the steamer and the two lodjor towed in addition a number of larger or smaller barges and boats intended for communication with the land. Siberia,* and especially the river territory of Jenisei, possesses rich coal beds, which probably extend under a great part of the Siberian plain, but as yet are not worked, and attract little attention. Like all the other steamers on the Siberian rivers, accordingly the *Alexander* was fired not with coal but with wood of which 180 fathoms, if I remember rightly, went to the voyage up the river. The steamer could carry only a small portion of this quantity, on which account frequent delays were necessary, not only for trading with the inhabitants, but also for taking fuel on board. The feeble engine, besides, notwithstanding that the safety valves were in case of need overloaded with lead weights, was often enough unable to make head with all it had in tow against the current, which at some places was very powerful, and in the attempt to find stream-free water near the banks, the vessel often went too near land and ran aground, notwithstanding the continual "ladno" cry of the pilot with the pole posted in the forepart of the steamer. We went, therefore, so slowly, that it was only after the lapse of a whole month that we reached the destination of the steamer, the town Jeniseisk, situated about 150 Swedish miles from Dudino.

In such circumstances most passengers by a steamer would be impatient and in bad humour. To us, on the contrary, the delay was welcome; inasmuch as we had thus an opportunity of extending our examination of the flora and fauna of the territory of the Jenisei even beyond the 60th degree of latitude. It is easy to see that a portion of these researches will also have a practical interest; for instance, the examination which Dr. Lundström has made of the flora of North Jenisei.

Our knowledge of it has heretofore been grounded chiefly on observations made by men of science (Middendorff, Schmitt, &c.) who have visited these regions for other purposes, and only in passing have had opportunities of turning attention to the flora. Dr. Lundström's main object, on the contrary, was exclusively botanical (he had before made himself well acquainted with the Arctic plant world by botanical journeys in Lapland and his native Nordland), and as he came during the voyage up the river from the northerly regions, poor in species, to the southerly, richer in species, it was easier for him than for one who travelled in an opposite direction to give the northern limit of a number of species of general occurrence common to Siberia and Scandinavia. Abundance of botanical and climatological material has been collected in this way, which naturally is not yet worked up, but it is easy to see what new light a comparison of the spreading of plants towards the north in our long-cultivated land and the desolate plains of Siberia will shed on the possibility of cultivating the latter country. Already I may be permitted here to mention that in opposition to what would have appeared probable beforehand the northern limit of many plants in Siberia *is situated farther towards the north than in Sweden.* To a certain extent this may perhaps depend on the seed being carried by the great river from more southerly southerly regions, but it also appears that the severe winter of Siberia has by no means any specially injurious influence on the vegetation of the summer.

Immediately after we came on board the steamer weighed anchor and steamed to the church village, Dudino, situated some miles up the river, where its tributary, the Dudinka, falls into it. The village consists of some few houses inhabited by an influential merchant, Sotnikoff, two priests, a "smotritel" (magistrate), a pair of exiles, and some workmen and natives. Sotnikoff carries on an extensive and profitable trade with the natives in the whole of the surrounding district, exchanging grain, cloth, tea, sugar, iron wares, gunpowder, lead, brandy, &c., for furs, fish, mammoth-teeth, &c., which last he sends with the steamer, first up the Jenisei, and afterwards by different methods of communication on to China, Moscow, Petersburg, &c. In his account of his well-known expedition for disinterring a mammoth found near the mouth of the Jenisei, the Petersburg academician Schmitt praises Sotnikoff much for the unselfish and energetic way in which the expedition was assisted by him. To us too was this plain unpretentious merchant specially hospitable and friendly, and it is incumbent on me to mention that we also met with the same reception from all the other notabilities of the place. The friendly clergyman, who was much interested in our journey, even performed a short thanksgiving service for the successful issue of the expedition on board the steamer and declined to accept any special honorarium on this account.

As in the more northerly situated "simovies," the houses in all the villages situated on the Jenisei were built of logs in much the same style as those of the well-to-do peasants in Russia, pretty close together, with richly decorated gables to the street or road of the village. The interior of the houses was, if we except the innumerable cockroaches found everywhere, very clean, and the walls were adorned with numerous, if not very artistically finished photographs and engravings for the most part of the Russian imperial family, remarkable Russian notabilities, generally in general's uniform, scenes from Russian history, &c. Richly ornamented consecrated pictures were always placed in a corner, and before these were always suspended some oil lamps or small wax lights, which were lighted on holydays. Sometimes the floor, at least in the principal room, was besides covered with

* As an instance, may be mentioned some exceedingly rich coal seams, which crop out on the eastern bank of the Jenisei, a little to the south of the town Krasnojarsk, just in the neighbourhood of the place where the "Pacific Railway" of Siberia will probably some day go forward. When I visited the place one of the coal seams was on fire. Nearer the mouth of the Jenisei, too, coal seams of considerable extent occur, for instance, at the bank of a tributary of the Jenisei, not far from Dudino.

mats of furs. The bed consisted of a couch near the roof, so extensive that it occupied a third or a half of the room, and so far from the floor that a man could go under it upright. Food was prepared in large baking ovens, which were daily fired for this purpose, and warmed the hut at the same time. New bread was to be had every day; and even for the poor a large brass tea urn was a necessary household article. We were always sure of meeting with a hearty and friendly reception wherever we stepped over the threshold, and if we stayed a short time we had generally to drink a glass of tea with our hosts whatever time of the day it might be. The dress everywhere somewhat resembled the common Russian; for the better classes for instance wide velvet trousers stuck into the boots, a shirt grandly embroidered with silver, and a wide caftan often trimmed with fur; for the poor, in case he was not too ragged, the same cut, but inferior, dirty, and torn material. During the winter, however, the Samoyede fur dress is worn out of doors both by high and low, by Russian and native, by settled and nomad.

For the present there were in these regions only very few persons who had been banished hither for political reasons, but on the contrary many exiled criminals, and among them also some few Finns, and even a Swede, or at least one who according to his own statement in broken Swedish had formerly served in the King's body-guard in Stockholm. Security for person and property was in all cases complete, and it was remarkable that there was no true difference of caste that could be observed between the Russian-Siberian natives and those who had been banished to those regions for crimes. Little interest even appeared to be taken in knowing the crimes which had caused the banishment. An inquiry on this point was generally met by the sufficiently elastic reply "for bad conduct."

I mentioned above that mammoth teeth here form an important article of commerce. They are also belived to occur in large quantity on the tundra, though the difficulty of communications often renders their removal impossible. Although this is the mammoth region proper, the larger parts of the skeleton are believed to be very rare, and still more mammoth with flesh, hide and hair still remaining. It was, for instance, on the peninsula between Obi and Jenisei, that the great mammoth find by Trofimoff occurred, and in the neighbourhood of the same place was found the mammoth which gave occasion to Schmitt's expedition. It is probable, besides, that the nomad native has the same indisposition to acquaint an official with a large mammoth find as the peasants at home had in former times, and in certain regions still have to give information about a supposed vein of ore.

On Sept. 4 the *Alexandr* weighed anchor, and steamed southwards during splendid weather.

The landscape now began by degrees to change its character completely. In fact, on most maps the limit of wood is drawn along the considerable bend which the river Jenisei makes immediately west or north-west of Dudino, and indeed here for the first time numerous pine trees are met with, but seldom more than 20 feet high. These cover the heights with a sparse and by no means attractive vegetation, completely destitute of the beautiful effect which distinguishes the willow and alder bushes farther north. Already some few miles south of Dudino, however, the pine forest became tall, though here we are still north of the Arctic circle. It is here that the forest proper commences—the largest forest of the globe—stretching with little interruption across the whole of Siberia, in one direction, from Ural to the Sea of Ochotsk, and in the other, south of the 58th or 59th degree of latitude, and north of the Arctic circle, at some places, for instance at the rivers Chatanga and Lena, beyond it on to the neighbourhood of 72° N. lat., that is to say, to the mouths of Chatanga and Lena, ten Swedish miles north of North Cape.

During our boat and steam voyage up the Jenisei we had heretofore only landed either upon the eastern bank of the river, which was always high, or on some of the numerous islands which at some places occur in the river, which widens out nearly to a lake. On Sept. 7 we had, for the first time, an opportunity of landing on the western bank of the river, which, like the western bank of most of the rivers flowing from the south to the north, consists of low tracts of land which are inundated in spring. This meadow land was now covered partly with an extraordinarily luxuriant carpet of grass, which of course was untouched by the scythe, partly with an exceedingly peculiar bush vegetation of equal height, in which we found a number of herbs known among us in Sweden, but here six to eight feet high. Compact thickets of a beautiful straight-stemmed willow frequently alternated with even grass turf of a lively green with small streams, tributaries of the Jenisei, in a way which gave the impression of the most beautiful park, carefully kept and watered, and kept clear of withered branches and grass. On the eastern side, on the contrary, the ancient forest proper commenced close to the river bank. Here nature had quite a different stamp of grandeur and gloom. The forest consisted principally of pines, which, even north of the Arctic Circle, were often of the most colossal dimensions, but in such cases many times grey and shortened to half their height by age. Between these the ground was so covered with fallen stems, with branches nearly fresh, half decayed or converted into a mass of wood mould, which was kept together merely by the bark, that one could force his way only with difficulty and with danger of breaking his legs in the thicket. The fallen stems were besides completely covered, many times even concealed by an uncommonly luxuriant moss vegetation; the tree lichens, on the contrary, occur here only sparingly, in consequence of which the spruce firs were devoid of the shaggy clothing common with us, and the bark on the birches which glanced out here and there among the spruce firs was distinguished by an uncommonly blinding whiteness. When one made his way into this monotonous wood a little distance from the river, it was necessary to be well acquainted with the points of the compass; a mistake in this respect had carried us in a direction in which at a distance of a hundred, perhaps two hundred (Swedish), miles, there was no probability of meeting with an inhabited place. In speaking of the vegetation in these regions it may be mentioned that in the northern forest along the river bank there was abundance of wild red and black currants exceedingly well tasted, and of dimensions surpassing even the largest varieties of cultivated currants I have had an opportunity of seeing.

Since we left Jewremow-Kamen, near the mouth of the Jenisei, we had not seen any solid rock at the river banks, but on the 8th we saw solid rocks on the eastern bank. We made here, as at a number of the other places at which we landed, a rich collection of land molluscs. By means of these collections, which have been already handed over to our skilful molluscologist, Dr. C. A. Westerlund, at Ronneby, to be examined, the known mollusc-fauna of North Siberia will be greatly increased, and many erroneous views hitherto prevalent regarding the geographical distribution of this interesting group of animals will be rectified. This holds good also of various land and freshwater invertebrates, of which considerable collections were made, which have already been distributed to specialists for examination.

After having remained for a longer or shorter time at about ten different "simovies" or fishing-stations, we came on Sept. 12 to a "simovie," Silivauskoi, exclusively inhabited by Skoptists. The orthodox Russian Church is, as is well known, tolerant towards men of foreign faiths, Lutherans, Catholics, Jews, Mohammedans, Buddhists, &c., but, on the contrary, in full accordance with what took place in former times within the Protestant world, visits sectaries within its own bosom with temporal punishments in this world and threatens them with eternal in another. Especially in former times have a number of sectaries been sent to Siberia, and there are accordingly peculiar colonies in a very prosperous state to be met with occasionally, exclusively inhabited by a certain sect. Such is the Skopt colony at Silivauskoi, of which it may be remarked that the nature of the religious delusion here excuses the stringency of the law or the administration. For, on the ground of a text in the Gospel of Matthew, interpreted in a peculiar way, all Skoptists subject themselves to a self-mutilation, in consequence of which the sect can exist only through new proselytes, and remarkably enough, these madmen, in fact, notwithstanding, or perhaps just on account of, all persecution, still find successors. A number of Skoptists are Ingrians (Finns from Ingermanland), on which account I could converse with them without difficulty. They related that they had "for righteousness' sake" been torn from their homes, imprisoned, flogged, and sent to Siberia. Here they had by industry and perseverance succeeded in attaining for themselves a certain competence, were hospitable and friendly, and bore with resignation their hard lot, assured that in another life they would reap a rich reward for their self-denial, suffering, and misfortunes here below. They did not kill any warm-blooded animal, "for it was a sin to kill what the Lord had created," which did not prevent them from catching and eating fish, nor from selling to us, who in any case were doomed to perdition, for 18 roubles a beautiful and fat ox, on condition that our own people should slaughter it. Their indisposition to use some animal foods had besides had the good result that their

attention was turned to the cultivation of the soil. Round the huts, accordingly, were patches of land in potatoes, turnips, and cabbage, which at least this year yielded abundant crops, though the colony is situated in the latitude of Avasaxa, that is to say, under the Arctic circle.

Later in the day we came to the Monastery of Troit, in former times renowned and rich, now inhabited only by a single monk, viz., the prior himself. He was a worthy old man, who gave us a hospitable and friendly reception. The apartment for the reception of guests was adorned with a number of portraits of Siberian bishops. There was besides a portrait of a Russian Czar in powdered hair and military uniform, with blue great cross riband. It was a portrait of Czar Paul, but through some exchange the Skoptists had taken it into their heads that the portrait represented their holy prophet, Czar Peter III., whose history they had completely altered in accordance with their idealised conception of the world. An educated man, who belonged to this sect, and on this account had been banished to North Jenisei, informed me accordingly in all seriousness that Czar Peter III. was not murdered, but was knouted and sent to Siberia, &c., all on account of his holiness—as so it happens now that in consequence of all this the portrait of Czar Paul in the Troit Monastery is a sacred picture to which worship is offered.

A. E. NORDENSKJÖLD

(*To be continued.*)

SCIENTIFIC SERIALS

THE *Journal of the Chemical Society* for December 1875 contains the following papers communicated to the Society:—On the agricultural chemistry of the tea-plantations of India, by J. Campbell-Brown, D.Sc. This lengthy paper contains analyses of the young and old leaves of good plants and of stunted and blighted plants of different varieties, analyses of the wood of good and stunted tea-plants of different varieties, analyses of tea-seed, of the soils of tea-plantations, and of tea from manured and unmanured plants. The author discusses also the analytical results.—On certain new reactions of tungsten, by Prof. J. W. Mallett, of the University of Virginia. The author has found, contrary to the statements in text-books, that the precipitate produced by hydrochloric acid in a solution of an alkaline tungstate is soluble in an excess of the concentrated acid. By adding fragments of metallic zinc to the above-named acid solution, various colours are produced, the most noteworthy being a brilliant magenta. Potassium sulphocyanate and metallic zinc added to the acid solution produce a rich green colour, but when the sulphocyanate is added first to the alkaline tungstate solution, then a considerable quantity of water, then hydrochloric acid, and finally zinc, a fine amethyst colour is produced. The blue colour well known as characteristic of one of the lower oxides of tungsten may be best brought out by the use of hyposulphurous acid (H_2SO_2) as the reducing agent.—The remainder of the journal contains the usual collection of abstracts.

American Journal of Science and Arts, Dec. 1875.—This number commences with a paper of careful observations by Prof. Dana on five of the river valleys of Southern New England, with a view to ascertaining the depression of that region during the melting of the glacier. This he estimates at about 15 feet. He considers that the terraces in the Housatonic, Connecticut, and Thames, which are now so high above the river's surface, were not wholly, or mostly formed when the land was at a much lower level then now, but they were formed when the rivers were at a greatly higher level than now, owing chiefly to the glacial flood. Thus we may have high and numerous terraces along valleys, and yet none be due to an elevation of the land. The height of the streams during the flood above high tide level is estimated in one case at as much as 237 feet (from which the 15 feet depression would be deducted). The amount of depression increased from the sound northwards at about one foot and a half per mile, since Dawson has shown that the height of the beaches at Montreal indicate a depression there of 500 feet. The waters from the melting glacier must have brought down the streams in vast volume to have piled to so great heights before outlets so wide and deep.—Prof. Storer, of Harvard, gives some observations which show (after Schönbein) that ammonia is a constant contaminant of sulphuric acid, and further, that it is a more frequent impurity in chemical substances (prepared with aid of sulphuric acid) than has been supposed.—An abstract is given of a memoir by Prof. Suess of Vienna on the origin of the Alps.—Mr. Andrews describes some new and interesting coal-plants from Perry County, Ohio, and Dr. Becker calls attention to a new feature in the "Comstock Lode" in Nevada.—In a letter from Dr. Gould, of Cordoba Observatory, the writer states that his zone observations, begun in 1872, are now completed; and the entire region from 23° to 80° of south declination has been carefully scrutinised. The 10° round the pole have been examined by Gillis at Santiago and Stone at Cape of Good Hope, and Gould's northern limit overlaps Argeländer's southern zone by eight degrees (as Argeländer had requested).

Supplementary December Number.—Mr. Langley here contributes a paper on the solar atmosphere, being introductory to an account of researches made at the Alleghany Observatory. The estimates of the absorptive power of this atmosphere, based on photometric comparison of the centre and edge of the sun, have been widely discrepant; thus Arago thought the light of the centre must be diminished 2·4 per cent. to equal that of the edge; Liais's estimate is 10 and Secchi's 78 per cent. Mr. Langley here describes a new method of measurement free from some of the objections to previous ones; and he thinks the estimates of Secchi (who used La Place's formula) are certainly in excess of the truth. Not much more or less than one half (he considers) of the whole so-called "luminous heat rays" are absorbed, turned back, or converted into work, in the sun's atmosphere. The total thermal absorption is somewhat less. The method is also applicable to sun-spots, &c., and Mr. Langley finds the absolute light of the "nuclei" in spots at least *five thousand times* that of the full moon.—In a supplemental paper on Southern New England during the melting of the great glacier, Prof. Dana discusses the overflows of the flooded Connecticut, which he concludes was at that time a great stream 150 feet deep and fifteen miles wide.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Jan 6.—On the length of the Spark from a Battery of 600, 1,200, 1,800, and 2400 rod-Chloride of Silver, and some Phenomena attending the Discharge of 5,640 Cells. By Warren De La Rue, D.C.L., F.R.S., and Hugo W. Muller, F.R.S.

On the 24th February, 1875,* we had the honour of communicating to the Society, in conjunction with our friend Mr. Spottiswoode, an account of some experiments to ascertain the cause of stratification in electrical discharges *in vacuo*. These experiments were made with a battery of 1,080 cells of powder-chloride of silver, which was described; we have now in action 3,240 such cells, and have recently completed 2,400 rod-chloride of silver cells,† making our total force 5,640 cells in action. To these will be shortly added another unit of 1,080 cells powder-chloride, and two other units of 1,200 rod-chloride, making a total of 9,120 cells.

We have more recently made a verbal communication to the Society of Telegraph Engineers, and also in October last a written one to the Académie des Sciences of Paris‡, wherein we have stated that the length of the spark in air appears to be in the direct ratio of the square of the number of cells.

Having completed the 2,400 cells, and charged them up in a single day, they were exactly in the same condition as to electromotive force and internal resistance, consequently they afforded the means of testing the truth of the law of the length of spark in a manner more efficacious than had hitherto obtained, the more especially as by the use of paraffin corks and other precautions we had obtained an excellent insulation.

Our assistant, Mr. Fram, has constructed a discharger which permits of the accurate measurement of the distance of the terminals to read to $\frac{1}{1000}$ of an inch, and by estimation to the tenth of that quantity. The nut, through which the screw ($\frac{1}{10}$ of an inch), carrying one of the terminals, works, is divided into two parts, which are separated by a spiral pressure-spring, so as to prevent shake. In making measurements the terminals are separated to a greater quantity than the anticipated striking-distance, and gradually approached until the spark passes; the discharger is then detached from the battery, and after reading the scale, connected up with a separate battery of 10 cells, with a detector-galvanometer in circuit. The terminals are again approached until the motion of the galvanometer indicates contact between

* Proc. Roy. Soc., No. 160, 1875.
† Proc. Roy. Soc., No. 160, 1875, p. 357.
‡ "Comptus Rendus," No. 16, p. 686; No. 17, p. 746, 1875.

them; the scale is again read, and the length of spark obtained by the difference between the first and second reading.

Rod-chloride, 600 cells had a striking-distance of 0·0033 in.
" 1200 " " 0·0130
" 1800 " " 0·0345
" 2400 " " 0·0535

Taking as the unit 600 cells, the spark of which was 0·0033, the length of spark of 1,200, 1,800, 2,400 would, according to theory, be that number multiplied by the squre of 2. 3, 4 respectively.

600 cells, striking-distance			0·0033 in.
1200	"	0·0033 × 4	0·0132
1800	"	0·0033 × 9	0·0297
2400	"	0·0033 × 16	0·0528

which numbers agree nearly with those obtained by experiment.

The length of the spark is much influenced by the shape of the terminals, those which we frequently employ consist of a point as one terminal and a plane for the other; hitherto we have used copper terminals, making the point and the plane alternately positive and negative by means of a double-key discharger, or by a rapidly-revolving commutator reversing up to 352 times in a second. One terminal in the above determinations consisted of a point of 30°, and the other of a slightly convex surface 0·46 inch in diameter.

While making these measurements, we noticed in a nearly dark room that when the point was negative a glow, in form like a paraboloid, was seen surrounding it long before the spark passed, and its appearance afforded by its increasing brilliancy useful information to guide us as to the more cautious approach of the terminals; gradually the sugar-loaf-like glow extended to the positive terminal. With 1,800 cells the glow was seen when the terminals were 0·0545 inch apart, the spark passing at 0·0345 inch; with 2,400 cells the glow began at a distance of 0·0865 inch, the spark passing at 0·0535 inch. Moreover, it was noticed that the disc (positive) became covered all over with a peach-like bloom, which became stronger in the centre as the terminals were made to approach each other, giving rise to Newton's iridescent rings.

In order to study more readily the phenomena accompanying the glow preceding the spark, the whole series of 5,640 cells was used, the terminals being a point as before of 30°, and sometimes a flat disc 1·1 inch in diameter, or a slightly convex one of 0·8 inch in diameter for the other. In all cases a peach-like bloom deposited on the disc, which was connected with the silver (positive) terminal; and when the flat disc was used the deposit was notably greater at the periphery and the centre than in other portions of it. With this number of cells, with the flat disc the glow occurred at 1·073 in., the spark at 0·139 in. With the slightly convex disc occurred at 1·124 in., the spark at 0·140 in.*

To ascertain whether a current really passed when the glow appeared, various vacuum-tubes were interposed in circuit between the battery and one of the terminals; in all cases they were illuminated even before a glow was perceptible on the negative pole; their interposition, as was to be expected, shortened the spark and diminished the distance at which the glow was perceptible. For example, with a hydrogen tube, having a capillary portion between two larger tubes, such as is used for spectrum experiments, and offering a resistance of 190,000 ohms, the glow occurred at 0·939 inch, the spark at 0·092 inch.

A tube of 31 inches between the terminals, and offering a resistance of 350,000 ohms, was brilliantly illuminated when interposed between one terminal and the battery; when the terminals were separated the extreme range of the discharge was 1·2 inch, and before any glow was visible at the negative electrode. How much further between the electrodes it will be possible to obtain a current has yet to be determined with a larger discharger now in course of construction.†

I have alluded to the resistance offered by vacuum-tubes. At first I experienced considerable difficulty in measuring it. For example, when in a Wheatstone's bridge the resistance of the tube was balanced by inserted resistances, the galvanometer could only for a short time be brought to rest, and it was then found that the cause of this was that the tubes rapidly increased in resistance as the current passed. After a time, however, they recovered their original resistance, sometimes rapidly, sometimes only after the lapse of days. The resistances were found not to be dependent on the length of tube, but to a great extent on their bore, capillary tubes offering a considerable resistance. Ultimately it was found that it was better to discard the indications of the galvanometer, and to rely solely on the appearance of a luminosity in the tubes placed on one side of Wheatstone's bridge as soon as the insertion of a balancing resistance was made in the other.

Later on we hope to have the honour of sending to the Society a more detailed statement of our experiments in support of those now quoted, and in confirmation of our former paper on the cause of stratification in electric discharges *in vacuo*.

In conclusion we venture to draw attention to the following consequences of the law of the length of spark being dependent on the ratio of the square of the number of cells of a voltaic battery, in the event of its being confirmed by experiment. Taking as a basis the spark with 600 cells of the rod-chloride of silver battery = 0·0033 inch, a unit of 1000 such cells would give a spark of $\frac{0033 \times 1000^2}{600^2} = 0{\cdot}009166$ inch,

one hundred units (100,000) a spark of 91·66 inches,
a thousand units (1,000,000) " 91·66 " = 764 feet nearly,

whereas a single cell would have a striking-distance of $\frac{1}{1000000}$ of an inch only. As far as our own experiments have gone the law has been confirmed; and although a million cells will probably never be made, a hundred thousand come within the range of experimental possibility.

Geological Society, Jan. 19.—John Evans, president, in the chair.—James Buckingham Bevington, William P. Blake, James Gordon Brickenden, Edward George Dyke, Henry Hamilton Gunn, William Jerome Harrison, and R. G. Warton, were elected Fellows of the Society.—On some unicellular algæ parasitic within Silurian and Tertiary corals, with a notice of their presence in *Calceola sandalina* and other fossils, by Prof. P. Martin Duncan, F.R.S. After noticing the works of Quekett, Rose, Wedl, and Kölliker, which refer to the existence of minute parasitic borings in recent corals, recent shells, and a few fossil mollusca, the author describes the appearance presented by a great system of branching canals of about 0·003 millim. in diameter, in a Thamnastræan from the Lower Cainozoic of Tasmania. He then proceeds to examine the corresponding tubes in *Goniophyllum pyramidale* from the Upper Silurian formation. In sections of that coral one set of tubes runs far into the hard structure; these are straight, cylindrical, and contain the remains of vegetable matter. Neither these tubes, nor any others of the same parasite, have a proper wall: they are simply excavations, the filiform alga replacing the organic and calcareous matter abstracted. In some places the dark carbonaceous matter is absent, and the lumen of the tube is distinguishable by the ready passage of transmitted light. Other tubes run parallel to the wall, and enter by openings not larger than their common calibre. But there are others which have a larger diameter, and in which the cytioplasm appears to have collected in masses resembling conidia; and where fossilisation has destroyed much of the continuity of a tube a series of dark and more or less spherical bodies may be seen. In some places, especially in the spaces between the minute curved dissepiments and tabulæ, hosts of globular spores, with or without tubes emanating from them, may be seen. In *Calceola sandalina* corresponding structures exist sometimes, and the method of entry of the parasite can be examined. The author gave two instances, one of which was seen in section. A decided flask-shaped cavity existed in the wall of the shell, opening outwards and rounded and closed inwards. It was crowded with globular spores (oospores), and these, where near the sides, had penetrated the hard shell, and thus gave a rugged and hairy appearance to the outline of the flask-shaped cavity. After noticing minute structures in a brachiopod included in a Silurian coral, and in a Lower Silurian foraminifer, the author asserted, from the results of his late researches upon the algæ parasitic in corals out of his own aquarium, that the fossil and recent forms are analogous in shape, size, and distribution. He considers that the old parasite resembles *Saprolegnia ferox* in its habit; and as he considers that *Empusina*, *Saprolegnia*, and *Achlya*—members of the Protista—are the same organisms, living under different physical conditions, he names the old form *Palæachlya penetrans;* and he believes that it entered the wall by the spores fixing on to the organic matter, and growing by its assimilation, and that car-

* Postscript, Jan. 7.—At the suggestion of Prof. Stokes, who saw the experiment repeated, the point was made positive, when a longer spark was obtained, namely, 0·154 inch and 0·164 inch.

† Postscript, Jan. 8th.—A current was obtained with the negative point distant 5·1 inches from a positive plate 6 inches in diameter.

bonic anhydride was evolved. He considers that this acid, assisted by the force of growth and the movement of the cytioplasm, are sufficient to account for the presence of the tubes. Finally, the author draws attention to the probable similarity of external conditions in the Silurian and present times, and to the wonderful persistence of form of this low member of the Protista.—How Anglesey became an Island, by Prof. A. C. Ramsay, F.R.S. The author described and illustrated by sections drawn to scale the contours of the island of Anglesey and the adjacent parts of Carnarvonshire, and noticed that the whole island may be regarded as a gritty undulating plain, the higher parts of which attain an average elevation of from 200 to 300 feet above the sea-level. Similar conditions are presented by the country for some miles on the other side of the straits, and in both the general trend of the valleys is north-east and south-west. The rock surfaces, when bare, show glacial striæ running generally in a direction 30° to 40° west of south. The author indicated that the great upheavals of the crust of the earth forming mountains took place long before the commencement of the Glacial epoch, and that ordinary agents of denudation had ample time for the formation in mountain regions of deep valleys, down which, during the Glacial epoch, glaciers would take their course. He noticed the evidence of this local glaciation furnished by the striation of the Welsh mountains, from which he inferred that these mountains as a whole were not overridden by a great ice-sheet coming from the north, and he described the course of the glaciers flowing from the north-west slopes of Snowdonia as being in the directions west, north-west, and north. These glaciers, however, did not reach the region now occupied by the Menai Straits, but spread out in broad fans on the north-western slopes of the hills now overlooking the Straits, a fact indicated by the directions of the glacial striæ in these parts. Anglesey, therefore, was not glaciated by ice-masses coming from Snowdonia ; and as the striations on that island point directly towards the mountains of Cumberland, the author inferred that these markings were produced by a great ice-flow coming from that region, reinforced probably by ice-streams from the north of Scotland, and which were large and powerful enough to prevent the glaciers of Llanberis and Nantffrancon from encroaching on the territory of Anglesey. The author described the rocks bordering the Straits as consisting of nearly horizontal Carboniferous strata, which, from appearances, must once have filled the whole of the region now occupied by the Straits. He considered that the softer shaly, sandy, and marly beds, remains of some of which are still to be seen on the coast, were swept away by the action of the great glacier coming from the north-east, forming a valley now occupied by the sea ; and in support of this view he cited the valley of Malldraeth Marsh, running across Anglesey, parallel to that of the Menai Straits, about four miles to the north-west, which a very slight change in conditions would convert into a fjord, differing from the Straits only in being closed at the north-east end.

Meteorological Society, Jan. 19.—Dr. Mann, president, in the chair.—The report of the Council showed that a large amount of work had been done, and that the number of Fellows had greatly increased. The first-class observing stations, which were organised in 1874, have been in regular working order during the past year, their number has been increased, and several have been reinspected. A very interesting account of all that has been done in organising the stations, with the conditions to be fulfilled by the observers in respect to instruments and exposure, the mode of inspecting, and a concise description of each station, with a ground plan on an uniform scale, has been prepared by Mr. Symons. An arrangement has been entered into with the Meteorological Office by which the Society has agreed to furnish, for a consideration, copies of observations from a definite number of stations. Various instructions for observers, prepared by the Station Committee and the Assistant-Secretary, are also given. The joint Committee of Delegates from this and other Societies, appointed to draft complete instructions for the observation and registration of natural periodical phenomena, have finished their labours and sent in their report. A code of rules entitled "Instructions for the Observation of Phenological Phenomena" has been prepared and published. The Rev. T. A. Preston has discussed the first year's observations, and his report is given in full. The Council have taken up the solar radiation observations commenced by the Rev. F. W. Stow, but they intend to compare the readings of the black bulb thermometer *in vacuo* with a bright bulb thermometer also *in vacuo*, both mounted alike, instead of the maximum thermometer in the shade. The Council have also appointed a Permanent Lightning Rod Committee to investigate and record accidents from lightning, to inquire into the principles involved in the protection of buildings, to diffuse exact information regarding the best form and arrangement for lightning conductors, and to consider all phenomena of atmospheric electricity. The balance-sheets show that the Society is in a very satisfactory condition.—The President then delivered his address. In alluding to the establishment of a carefully planned series of observing stations by the Society he illustrated at some length the absolute necessity of following out the inductive method of research in meteorology, and supported his argument by a reference to the history of all the leading branches of physical investigation, in which the prophetic insight of inspired minds had invariably had to be elaborated and perfected by the patient labour of subsequent observation and experiment. He compared the meteorological doctrine of high and low pressure areas of the atmosphere, and of the movement of currents of the air, under the influence of the barometric gradient, to the Newtonian doctrine of gravitation in astronomical physics, to the Daltonian hypothesis of atomic proportions in chemistry, to the dynamic theory of the tides, and to Avogadro's law of the uniformity of the atomic constitution of gases under like conditions of pressure and temperature, and maintained that the perfection and practical application of this law must be worked out by organised and carefully thought-out plans of observation such as are now being used by the Society, and also under circumstances of higher opportunity and greater facility by the Meteorological Office of the Government. The President incidentally remarked that he believed the recent researches into the vertical circulation of the water of the ocean under the influence of the different specific gravities of its distant parts was virtually tending to the establishment of the same great influence, as being the moving spring of the physical dynamics of both the ocean and the atmosphere. The President also in allusion to the recent establishment of a Permanent Lightning Rod Committee by the Society, gave a very interesting account of a visit he had recently made to Prof. Melsens, of Brussels, and described the experiments upon which the Professor is engaged in investigating the molecular changes brought about in conducting bodies by the passage through them of powerful discharges of high tension electricity. He also gave an elaborate account of the admirable system of defence against lightning, which has been adopted at the Hotel de Ville of Brussels. Some curious and notable instances of the molecular effects of lightning discharge were exhibited during the delivery of the latter portion of the address.—The following gentlemen were elected Officers and Council for the ensuing year :—President, Henry Storks Eaton, M.A. Vice-Presidents : Charles O. F. Cator, M.A., Rogers Field, Assoc. Inst. C.E., John Knox Laughton, F.R.A.S., Capt. Henry Toynbee, F.R.A.S. Treasurer, Henry Perigal, F.R.A.S. Trustees : Sir Antonio Brady, F.G.S., Stephen William Silver, F.R.G.S. Secretaries : George James Symons, John W. Tripe, M.D. Foreign Secretary, Robert H. Scott, F.R.S. Council : Percy Bicknell, Arthur Brewin, F.R.A.S., Charles Brooke, F.R.S., Cornelius Benjamin Fox, M.D., Frederic Gaster, James Park Harrison, M.A., Robert James Mann, M.D., F.R.A.S., William Carpenter Nash, Rev. Thomas Arthur Preston, M.A., William Sowerby, F.L.S., Charles Vincent Walker, F.R.S., George Mathus Whipple, F.R.A.S.

Anthropological Institute, Jan. 25.—Col. A. Lane Fox, president, in the chair.—Annual Meeting.—The Report of Council for 1875 was read.—The following were elected to serve as Officers and Council for 1876 :—President, Col. A. Lane Fox, F.S.A. Vice-presidents : Prof. Geo. Busk, F.R.S., John Evans, F.R.S., A. W. Franks, F.R.S., Francis Galton, F.R.S., Geo. Harris, F.S.A., E. Burnet Tylor, F.R.S. Directors : E. W. Brabrook, F.S.A., Capt. Harold Dillon. Treasurer, J. Park Harrison. Council : J. Beddoe, F.R.S., W. Blackmore, Sir Geo. Campbell, K.C.S.I., Hyde Clarke, J. Barnard Davis, F.R.S., W. Boyd Dawkins, F.R.S., Robert Dunn, F.R.C.S., David Forbes, F.R.S., Chas. Harrison, F.R.S.L., H. H. Howorth, Prof. T. McK. Hughes, F.G.S., Prof. Huxley, F.R.S., A. L. Lewis, Sir John Lubbock, Bart., F.R.S., F. G. H. Price, F.R.G.S., J. E. Price, F.S.A., Prof. Rolleston, F.R.S., C. R. Des Ruffières, F.R.S.L., Lord Arthur Russell, M.P., M. J. Walhouse.

Institution of Civil Engineers, Jan. 18.—Mr. G. R. Stephenson, president, in the chair.—The following paper was read :—On the ventilation and working of railway tunnels, by Mr. Gabriel James Morrison.

GENEVA

Physical and Natural History Society, Jan. 6.—M. Ernest Favre took up the discussion which has existed for ten years among geologists and palæontologists on the limit of the Jurassic and Cretaceous beds in the Alps, where the beds are not separated, as in the Anglo-Parisian basin, by freshwater deposits. Oppel, in 1865, gave the name of Tithonic stage to the beds containing Cephalopodous and Coralline faunæ, and which are found in the upper part of the Jurassic system. Geologists, mostly French, of whom M. Hébert is the best known representative, assigning a part of these deposits to the Cretaceous formation and regarding the zone of *Ammonites tenuilobatus* as Oxfordian because it is covered by Coraliferous beds, admit that there is in the Alps a great gap between the Oxfordian and the Cretaceous formations. German and Swiss geologists, on the contrary, find in the Alps the complete series of the Upper Jurassic system of the Jura. They have shown that Coraliferous is developed in nearly all the horizons of these beds, and not only in that to which D'Orbigny has given the name of Coralline stage, a name which ought to be suppressed; that the highly developed zone of *Ammonites tenuilobatus* in the Alps is Kimmeridgian, and that the Tithonic beds belong to the Jurassic formation. M. Favre has found in the Western Alps of Switzerland the complete series of these strata; he has described it in a memoir on the Upper Jurassic formation Voirons. This series has the following four divisions from below upwards:—1. The Oxford formation, properly so called. 2. The zone of *Ammonites bimammatus*, which contains many species of the zone of *Amm. transversarius*. 3. The zone of *Ammonites Acanthicus* and *A. tenuilobatus* (Astartian). 4. Tithonic beds, which are the equivalent of the Solenhofen beds. The Voirons formation includes Nos. 2 and 3. The passage from the Jurassic to the Cretaceous systems has been worked in a part of the Alps, without any interruption in the four divisions; and if we cannot find all the equivalents of the fossiliferous beds of the Jurassic basin, it should be remembered that the deposits have been placed in the former region in conditions different from those which have reigned in the second.

PARIS

Academy of Sciences, Jan. 24.—Vice-Admiral Paris in the chair.—The following papers were read:—On the decomposition of water by platinum, by MM. Sainte-Claire Deville and Debray. When a mixture of cyanide of potassium with spongy platinum is heated in a glass vessel raised to 500° or 600° near a dish of tepid water, *in vacuo*, large quantities of hydrogen are produced, and a double cyanide of platinum and potassium. A concentrated solution of cyanide of potassium attacks platinum at the boiling temperature.—Action of monohydrated sulphuric acid on alcohols, by M. Berthelot. He measures the heat liberated in such reactions.—New case of aphasia or loss of speech, arising from loss of the co-ordinated movements necessary for the act of pronunciation of words, without any lesion of the intellectual faculties, by M. Bouillaud.—On the falling in of the Cirque de Salazie, in the Isle of Réunion, by M. Sainte-Claire Deville.—On the star 70 ρ Ophiuchus, by M. Tisserand. He seeks to determine the orbit from 213 observations, comprising an entire revolution.—Report on the numbers of the *Revue d'Artillerie* submitted to examination of the Academy by the Minister of War.—Application of the mechanical theory of heat to the study of volatile liquids; simple relations between the latent heats, atomic weights, and tensions of vapours, by M. Pictet. *Inter alia*, latent heat multiplied by atomic weight (temperature and pressure being the same) gives a constant product. The difference of latent heats at any two temperatures multiplied by atomic weight is a constant number. The latent heats of all liquids are multiples of the specific heats.—Action of ammonia on rosaniline, by M. Jacquemin.—Researches on the constitution of collagenous matters, by MM. Schützenberger and Bourgeois.—Map of the globe in gnomonic projection on the horizon of the North Pole, by M. Thoulet.—On the action of cold on milk, and the products obtainable from it, by M. Tisserand. The rising of cream is quicker, and the volume of it greater, the nearer the temperature has been brought to zero; also the yield of butter is greater, and the milk creamed, butter and cheese are of better quality, the lower the temperature. The common practice might be greatly improved in this respect.—On the covariants of binary forms, by M. Jordan.—On a particular class of left inscriptible polygons, by M. Serret.—Magnetic actions on the rarefied gases in Geissler tubes (fourth note), by M. Chautard. The gaseous matter probably undergoes attraction or repulsion under action of the magnet, resulting in compression against the side of the tube and change in the physical state of the luminous stream. The alteration of the spectrum by magnetism is more marked, the greater the diameter of the tube (from $\frac{1}{10}$ mm. to 1 cm. in these experiments). With fluoride of silicium Geissler tubes, the author appears to find some indication of a new chemical reaction under magnetic influence.—On the spectrum of nitrogen and that of alkaline metals in Geissler tubes (continued), by M. Salet. He suggests that the lines described by Mr. Schuster in 1872 may have been those of sodium vapour.—On the action of heat in magnetisation, by M. Favre. Three phenomena observed:—1. Conservation of magnetism at any temperature, when the latter was maintained constant. 2. Diminution of the magnetism in cooling, at first slow, becoming very rapid after a time variable with the temperature of magnetisation. 3. Increase of the quantity of magnetism that remains after cooling, when the magnet is heated anew.—Note on a new system of electric lamp, with independent regulator, by M. Girouard.—On a new method of recording the movements of blood-vessels in man, by M. Mosso. We shall notice this separately.—Note on the development of the *Salmacina Dysteri*, Hux., by M. Giard. Several characters bring the embryo of *Salmacina* near that of Molluscs. The divergence between Molluscs and Annelids commences only after the Trochosphæra stage, and even after this there are many agreements. The parentage of Molluscs and Annelids is certainly nearer than that of the latter with Arthropods. The origin of the three groups must be sought among the Rotifers.—New fossil mammifers from the deposits of phosphate of lime at Quercy, by M. Filhol.—Influence of various elements of manures on the development of the beet, and its saccharine richness, by M. Joulie.

French Physical Society, December 17, 1875.—M. Jamin communicated the formulæ which he has established to represent the distribution of magnetism in magnets furnished with contact armature. If the armature is indefinite, the magnetic intensity in the soft iron is represented by an exponent of a single term, as in the case of magnets of very great length; if the armature is shorter the intensity is given by the sum of the two exponents. The diminution of intensity in each point of the magnet follows the same law, and the constants of the formulæ may be determined by noting on the one hand that the total loss of magnetism on the magnet is equal to the gain in the armature, and on the other hand, that the intensity at the point of contact is the same in the armature and in the magnet.

VIENNA

Imperial Academy of Sciences, Dec. 16, 1875.—On differential air thermometers, by M. Pfaundler. Berthelot's air thermometer with capillary manometer has the drawback, that its data depend on the existing barometric state. M. Pfaundler seeks to obviate this by his differential air thermometers. He gives various constructions of these.—On new fish species from the collections of the Imperial Zoological Museum, by M. Steindachner. Mostly species of siluroids from the Bay of Panama, &c.—On the flow of stratified clay under bodies pressed into it, by M. Obermayer.

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